This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

**Usage guidelines**

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

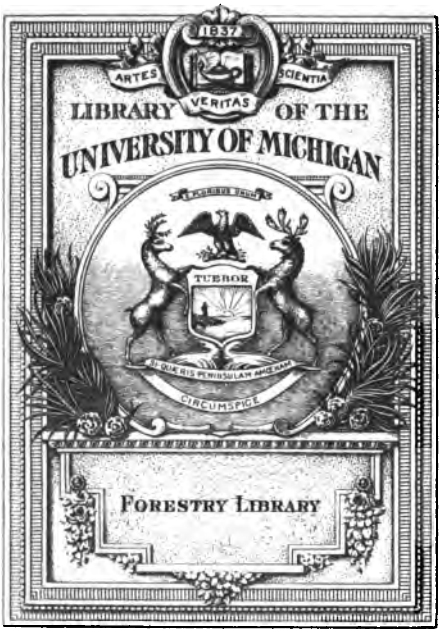
+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

**About Google Book Search**

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

BUHR B

a[redacted] 00001403 [redacted]



LIBRARY OF THE
UNIVERSITY OF MICHIGAN

FORESTRY LIBRARY

orestry
SD
431
.U63

Chittenden

Issued Aug. 15, 1917.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY.

CONTRIBUTION FROM THE BUREAU OF ENTOMOLOGY, L. O. HOWARD, CHIEF,
IN COLLABORATION WITH THE FEDERAL HORTICULTURAL
BOARD, C. L. MARLATT, CHAIRMAN.

# A MANUAL
OF
# DANGEROUS INSECTS
## LIKELY TO BE INTRODUCED IN THE UNITED STATES THROUGH IMPORTATIONS.

EDITED BY

W. DWIGHT PIERCE,
*Entomologist, Southern Field Crop Insect Investigations.*

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1917

MU

This compilation was only possible by the cooperation of all the divisions of the Bureau of Entomology, some of which prepared the matter in the form in which it now appears. The editor therefore wishes to acknowledge the assistance of Messrs. C. L. Marlatt, W. D. Hunter, A. D. Hopkins, the late F. M. Webster, F. H. Chittenden, A. L. Quaintance, W. R. Walton, E. R. Sasscer, Jacob Kotinsky, Dwight Isely, H. L. Sanford, and R. W. Rust for the collection of the notes on the insect enemies of the crops investigated by them, and of Messrs. W. R. Walton, Harry B. Bradford, and the late J. F. Strauss in the preparation of the illustrations.

The lists of insects included in this manual are necessarily incomplete, and no doubt important species have been omitted. Frequently the literature on dangerous species is so meager as to make it impossible to conclude as to the importance of the species.

Regarding the nomenclature, it should be remembered that this work is strictly a compilation. Many of the names will undoubtedly be changed as the result of future studies. The ones used, however, are the ones current in European literature. To have attempted to make the nomenclature more exact would have involved practically the revision of many large groups of insects. This would have been entirely impracticable and would have delayed publication of the manual for years. Moreover it would have resulted in a publication which inspectors would have had difficulty in using on account of the fact that the literature accessible to them would have, in many cases, used other names. In order to make future editions of this handbook more useful, the bureau will be greatly obliged for criticism, additions, and recommendations as to treatment.

The majority of the insect pests in the United States which now occasion the greatest damage to orchard, field, and garden crops and to stored products and in homes, etc., are of foreign origin, and were introduced with the host plants or accidentally in the course of commerce. Such introductions of new pests are going on all the time, as illustrated by such recent arrivals as the Argentine ant in New Orleans and the alfalfa leaf weevil in Utah. The list of over 100 introduced insect pests given below illustrates the nature of the most important of these introductions in the past. This handbook contains the names of hundreds of other insects which now occur in different parts of the world and which are liable to be introduced at any time with nursery stock or in merchandise or as accidental guests or stowaways on ships or in baggage. It also includes a considerable number of introduced pests which are not now generally distributed and which therefore should be guarded against both as to further entry and to further distribution within the United States.

Throughout the work species which have been introduced into the United States are marked with an asterisk (*) and the fact of the introduction is mentioned. Many of the most important introduced insects are omitted because they are now so generally distributed that the importation of a few additional individuals will have no effect upon the existing economic conditions.

## LIST OF IMPORTANT FOREIGN INSECTS WHICH HAVE BEEN INTRODUCED INTO THE UNITED STATES.

### MITES (ACARINA).

Orange rust mite or lemon mite. *Eriophyes oleivorus* Ashmead. (See Citrus.)
Grape blister mite. *Eriophyes vitis* Landois. (See Grape.)
Pear leaf blister mite. *Eriophyes pyri* Pagenstaecker. (See Pear.)
Plum blister mites. *Eriophyes phlœocoptes* Nalepa and *E. padi* Nalepa. (See Plum.)
Potato root mite. *Rhizoglyphus* (*Cœpophagus*) *echinopus* Fumouze and Robin. (See Potato.)

### THRIPS (THYSANOPTERA).

Onion thrips. *Thrips tabaci* Lind.
Pear thrips. *Tæniothrips pyri* Daniel.
Red-banded thrips. *Heliothrips rubrocinctus* Giard. (See Fruits.)

### SCALES, BUGS, APHIDS (HEMIPTERA).

San José scale. *Aspidiotus perniciosus* Comstock.
Apricot scale. *Epidiaspis piricola* Del Guercio. (See Apricot.)
Greedy scale. *Aspidiotus camelliæ* Signoret (*rapax* Comstock). (See Asparagus.)
Box scales. *Aspidiotus* (*Chrysomphalus*) *dictyospermi* Morgan, *Aspidiotus britannicus* Newstead, and *Pinnaspis buxi* Bouché. (See Box.)
Catalpa scale. *Diaspis pentagona* Targioni. (See Catalpa.)
Citrus scales. *Aspidiotus orientalis* Newstead and *Parlatoria zizyphus* Lucas. (See Citrus.)
Coconut palm scale. *Aspidiotus* (*Chrysomphalus*) *perseæ* Comstock. (See Coconut palm.)
Fig scales. *Conchaspis angræci* Cockerell and *Lepidosaphes ficus* Signoret. (See Ficus.)
Hawthorn scales. *Lecanium bituberculatum* Targioni. (See Hawthorn.)
Mango scales. *Coccus mangiferæ* Green and *Leucaspis indica* Marlatt. (See pl. I, fig. 1.) (See Mango.)
Oak scales. *Asterolecanium variolosum* Ratzeburg. (See Oak.)
Orchid scales. *Aspidiotus* (*Targionia*) *biformis* Cockerell, *Parlatoria proteus* Curtis, and *P. pseudaspidiotus* Lindinger. (See Orchid.)
Pear scale. *Aspidiotus* (*Diaspidiotus*) *ostreæformis* Curtis. (See Pear.)
Rose scale. *Leucaspis japonica* Cockerell. (See Rose.)
Sago palm scale. *Diaspis zamiae* Morgan. (See Sago Palm.)
Sugar-cane mealy-bug. *Pseudococcus texensis* Tinsley. (See Sugar cane.)
Black scale. *Saissetia oleæ* Barnard.
Fluted scale. *Icerya purchasi* Maskell. (See pl. II, fig. 2.)
Oystershell scale. *Lepidosaphes ulmi* Linnæus.
Purple scale of the orange. *Lepidosaphes beckii* Newman.
Hop aphis. *Phorodon humuli* Schrank.
Spinach aphis, *Myzus persicæ* Sulzer.
Cabbage aphis, *Aphis brassicæ* Linnæus.
Melon aphis. *Aphis gossypii* Glover.
Pea aphis. *Macrosiphum pisi* Kaltenbach.
Bean aphis. *Aphis rumicis* Linnæus.
Wheat plant louse. *Aphis avenæ* Fabricius.
Pear-tree psylla. *Psylla pyricola* Förster.
Tarnished plant-bug. *Lygus pratensis* Linnæus.
Cotton stainer. *Dysdercus suturellus* Herrich-Schaeffer. (See Cotton.)

### BEETLES (COLEOPTERA).

Beet carrion beetle. *Blitophaga opaca* Linnæus. (See Beet.)
Red-legged ham beetle. *Necrobia rufipes* De Geer.
Leather beetles. *Dermestes vulpinus* Fabricius and *D. frischi* Kugelann.
Pear borer. *Agrilus sinuatus* Olivier. (See Pear.)
Confused flour beetle. *Tribolium confusum* Duv.
Saw-toothed grain beetle. *Silvanus surinamensis* Linnæus.
Cadelle or bolting-cloth beetle, *Tenebrioides mauritanicus* Linnæus.

Lesser grain-borer, *Rhizopertha dominica* Fabricius.
Drug-store beetle, *Sitodrepa panicea* Linnæus.
Cigarette beetle, *Lasioderma serricorne* Fabricius.
Rust-red flour beetle, *Tribolium ferrugineum* Fabricius.
Poplar borer. *Saperda carcharias* Linnæus. (See Poplar.)
Willow leaf-beetle. *Phyllodecta vitellinae* Linnæus. (See Willow.)
Elm leaf-beetle. *Galerucella luteola* Müller.
Crucifer leaf-beetles. *Phyllotreta vittata* Fabricius and *P. armoraciæ* Koch. (See Crucifer.)
California grape rootworm. *Adoxus obscurus* Linnæus. (See Grape.)
Beet tortoise beetle. *Cassida nebulosa* Linnæus. (See Beet.)
Asparagus beetle. *Crioceris asparagi* Linnæus. (See Asparagus.)
Asparagus beetle. *Crioceris 12-punctata* Linnæus. (See Asparagus.)
Bean weevils. *Mylabris*[1] *rufimanus* Boheman, *M. pisorum* Linnæus, *M. lentis* Frölichs, *Acanthoscelides obtectus* Say, *Pachymerus chinensis* Linnæus, *P. quadrimaculatus* Fabricius. (See Beans.)
The poplar and willow curculio. *Cryptorhynchus lapathi* Linnæus. (See Alder, Birch, Poplar.)
Austrian alfalfa leaf weevil. *Hypera meles* Fabricius. (See Alfalfa.)
The clover leaf weevil. *Hypera punctata* Fabricius. (See Alfalfa.)
The alfalfa weevil. *Hypera postica* Gyllenhal. (See Alfalfa.)
Clover leaf weevils. *Hypera meles* Fabricius and *Hypera nigrirostris* Fabricius. (See Clover.)
Broad-nosed grain weevil. *Caulophilus latinasus* Say. (See Avocado.)
Root weevils. *Polydrusus sericeus* Schaller and *P. viridicollis* Baudi. (See Beech.)
Coffee-bean weevil. *Aræcerus fasciculatus* De Geer. (See Corn.)
Sweet-potato weevil. *Cylas formicarius* Fabricius.
Clover root weevils. *Sitona flavescens* Marsh and *Sitona hispidula* Fabricius. (See Clover.)
Strawberry root weevil. *Brachyrhinus ovatus* Linnæus (*Otiorhynchus*). (See Conifers.)
Grain weevils. *Calendra granaria* Linnæus and *C. oryza* Linnæus. (See Corn.)
Grape root weevil. *Brachyrhinus sulcatus* Fabricius. (See Grape.)
Fruit-tree bark beetle. *Scolytus rugulosus* Ratzeburg.

## MOTHS (LEPIDOPTERA).

The gipsy moth. *Porthetria dispar* Linnæus. (See Forests.)
The cotton bollworm. *Chloridea obsoleta* Fabricius.
The beet army worm. *Laphygma exigua* Hübner (*Caradrina*).
The apple moth. *Argyresthia conjugella* Zeller. (See Apple.)
Horse-chestnut borer. *Zeuzera pyrina* Linnæus. (See Horse-chestnut.)
Beech tortricid. *Peronea ferrugana* Treitschke. (See Beech, Birch.)
Hawaiian beet webworm. *Hymenia fascialis* Cramer. (See Beet.)
Beet worm. *Plusia gamma* Linnæus. (See Beet.)
Diamond-back moth. *Plutella maculipennis* Curtis. (Attacks turnip, cabbage, cauliflower.)
Cabbage webworm. *Hellula undalis* Fabricius.
Celery leaf-tyer. *Phlyctænia ferrugalis* Hübner.
European pine-shoot moth. *Evetria buoliana* Schiffermiller. (See Conifers, C.)
Pine bud and gall moths. *Evetria turionana* Hübner; *E. pinivorana* Zeller; *E. duplana* Hübner. (See Conifers, C.)
Brown-tail moth. *Euproctis chrysorrhœa* Linnæus. (See Forests.)
Pea moth. *Laspeyresia nigricana* Stephens. (See Pea.)
Sugar-cane borer. *Diatræa saccharalis* Fabricius. (See Sugar cane.)
Mediterranean flour moth. *Ephestia kuehniella* Zeller.
Imported cabbage butterfly. *Pontia rapæ* Linnæus.
Angoumois grain moth. *Sitotroga cerealella* Olivier.
Codling moth. *Laspeyresia pomonella* Linnæus.
European grain moth, *Tinea granella* Linnæus.
Indian-meal moth, *Plodia interpunctella* Hübner.
Fig moth, *Ephestia cautella* Walker.
Cutworms, *Peridroma*, *Agrotis*, *Feltia*, etc.

## SAWFLIES (HYMENOPTERA).

Coniferous sawfly. *Diprion simile* Hartig. (See Conifers, B.)
Currant worm. *Pteronidea ribesii* Scopoli.
Rose sawfly, *Cladius pectinicornis* Fouc.
Larch sawfly, *Nematus erichsoni* Hartig.
Rose sawfly *Caliroa aethiops* Fabricius.
Plum sawfly, *Eriocampoides limacina* Retzius.
Elm sawfly, *Fenusa dohrnii* Tischbein.

---

[1] The generic name Mylabris Geoffroy 1762 has precedence over Laria Scopoli and Bruchus Linnæus as used for the bean weevils and is the name which should be followed in future literature.—W. D. Pierce.

### FLIES (DIPTERA).

Imported cabbage maggot. *Chortophila* (*Pegomya*) *brassicæ* Bouché.
Seed-corn maggot. *Chortophila* (*Pegomya*) *fusciceps* Zetterstedt.
Grain gall midge. *Contarinia tritici* Kirby. (See Grains.)
Hessian fly. *Phytophaga destructor* Say (*Mayetiola*). (See Grains.)
Pear gall midge. *Contarinia pyrivora* Riley. (See Pear.)
Imported onion maggot. *Chortophila* (*Pegomya*) *cepetorum* Medde.
Spinach leaf miner. *Chortophila* (*Pegomya*) *hyoscyami* Linnæus (*vicina* Lintner).

## INSECTS SPECIALLY LIABLE TO IMPORTATION AT ANY TIME.

There are certain groups of insects which are uniformly injurious and can not therefore be given full justice in a bulletin of this type. These insects should be especially guarded against and excluded on general principles, whether incriminating evidence is found or not.

### TERMITES (TERMITIDÆ).

There have been several cases of introduction of termites into the United States, notable among which was the importation of *Leucotermes lucifugus* Rossi in packing boxes from Germany. The termites are uniformly injurious to wood and plant growth and may be imported in any type of wood, whether in the form of nursery stock, lumber, or manufactured product. A list of species is to be found in Wytsman's Genera Insectorum by Desneux (1903).

### THRIPS (THYSANOPTERA).

The tiny fringe-winged thrips are very destructive to many crops, and should always be guarded against.

### SCALE INSECTS (COCCIDÆ).

These tiny insects are inconspicuous and the greatest of care is necessary on the part of inspectors to prevent their introduction. This family may be considered, as a whole, a most undesirable group of insects. Many species have already been introduced and become serious pests. Reference to Mrs. Fernald's Catalogue of Coccidæ as well as Technical Bulletins 12 and 16 of the Bureau of Entomology will give full data as to literature. L. Lindinger, in his "Die Schildläuse (Coccidæ)," gives tables to the species of European scale insects attacking each plant. All names of scale insects used in this bulletin have been verified by Mr. E. R. Sasscer. Several genera of scales are illustrated on plates I–V to assist in determination. Some of the species illustrated are not treated in the text, although congeneric species are.

### WHITE FLIES (ALEYRODIDÆ).

The tiny white flies are very apt to slip in past even a zealous inspector. The flattened scalelike larvæ of some species look so much like the plant tissue that they are easily overlooked. The active little white-winged adults fly so quickly that rough handling would tend merely to disperse them and increase the dangers of introduction. Kirkaldy in 1907 issued a world checklist in Bulletin 2, Hawaii Board of Commissioners Agriculture and Forestry. (See Technical Bull. 27, of the Bureau of Entomology and Proc. U. S. Nat. Mus., No. 2156.)

### RED SPIDERS; MITES (ACARINA).

These tiny eight-legged creatures are not insects, but so closely related that they are generally treated as such. The red spiders are exceedingly minute and occur on almost every type of vegetation. As their rate of multiplication is very rapid they have become serious pests to agriculture. There are a number of four-legged blister mites of great importance and yet so small that they can only be seen with a very high power lens.

## BARKBEETLES (SUPERFAMILY SCOLYTOIDEA: FAMILIES IPIDÆ, SCOLYTOPLATYPODIDÆ, SCOLYTIDÆ, AND PLATYPODIDÆ).

All of the bark beetles, ambrosia bettles and other members of this family are more or less injurious to tree growth, forest products, tree seeds, fruits, etc., and species known to be injurious must be carefully guarded against. These beetles are small, cylindrical with elbowed and clubbed antennæ. The head is without or with very short beak and the submentum is without a gular peduncle. In Ipidæ and Scolytidæ (Hopkins's classification) the first joint of the tarsus is shorter than the others combined, while in Platypodidæ the first joint is as long or longer than the others. They all bore in the plant tissue to deposit their eggs and their burrows or galleries are characteristic of groups, genera, and species. The food consists of plant tissue except in the ambrosia beetles where it consists of so-called ambrosia fungi. Genera Insectorum has issued a fascicle on Ipidæ=Superfamily Scolytoidea of Hopkins,[1] with catalogue of species of the world.

## BEAN WEEVILS (MYLABRIDÆ—BRUCHIDÆ, LARIIDÆ).

The seed weevils or bruchids breed almost entirely in the seeds of plants, especially of the bean and pea family. They are uniformly injurious and should be excluded. These beetles are usually small and either oval or elongate, with the head carried in a downward position and with the antennæ often pectinate or plumose. The elytra do not completely cover the abdomen. A catalogue of the Mylabridæ (Bruchidæ) has been issued by Junk.

## CUTWORMS; ARMY WORMS (NOCTUIDÆ).

Several species of cutworms and army worms have already become world wide in their distribution through their strong flying ability and by commerce. As the larvæ are very generally destructive and not at all exclusive in food habits, they need to be carefully guarded against. Larvæ may be transported anywhere on the ships. *Cirphis unipuncta* Haworth, the army worm; *Spodoptera mauritia* Boisduval, the grass army worm, and *Agrotis ypsilon* Rottenburg, the greasy cutworm, are practically cosmopolitan. A discussion of most of the injurious species will be found in Sorauer's Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 348–374.

## WEEVILS. RHYNCHOPHORA—COLEOPTERA.

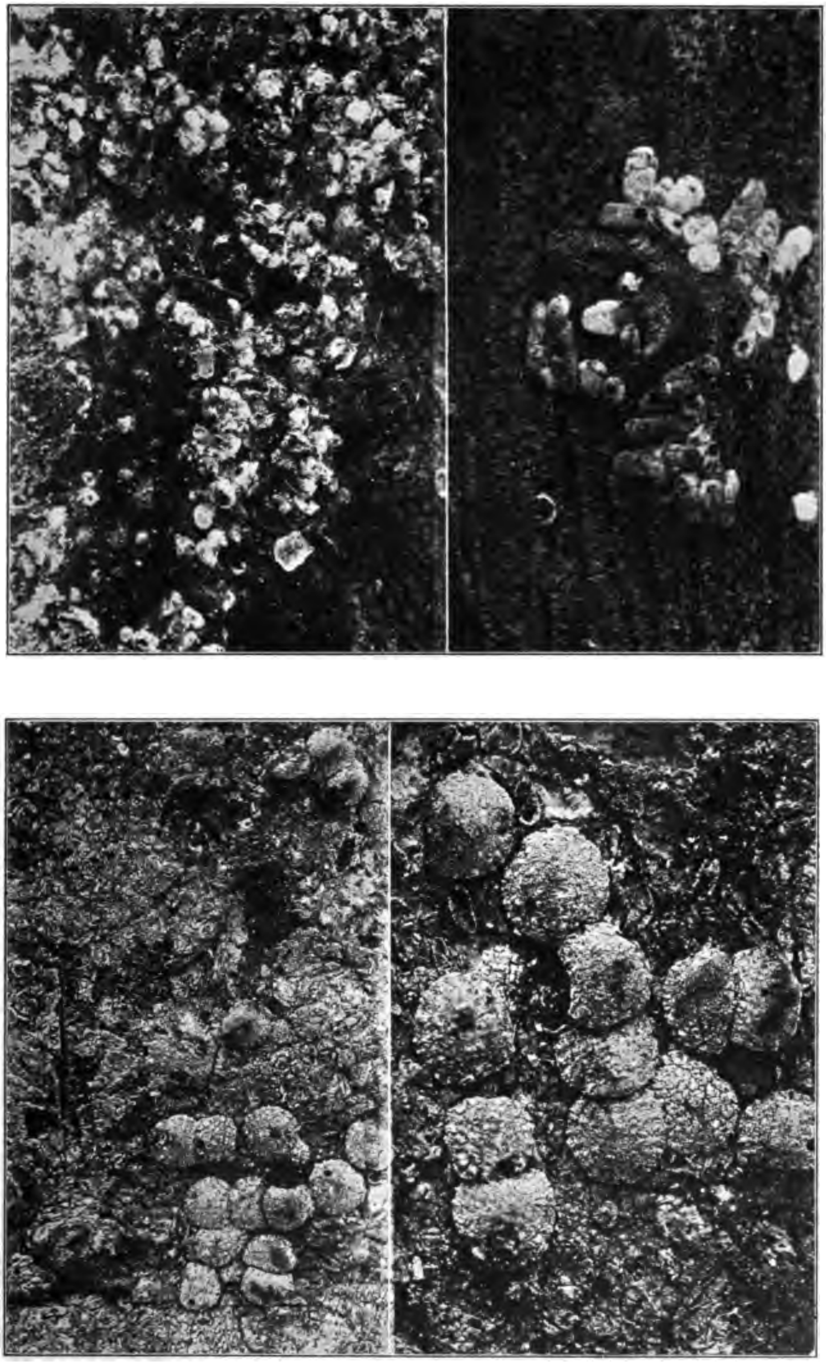
The experience of the last few years in the quarantine of horticultural products has shown that one of the groups most likely to introduction is the group of weevils which comprise a large section of the order Coleoptera.

Owing to the development of many species of weevils in the roots, stems, and fruit of almost every type of plant known, it is very easy to introduce them in immature stages in such a manner that they may take hold and attack the introduced plant. Owing to the necessity of determining practically all of the weevils introduced by a search through foreign literature a majority of the species so far introduced

---

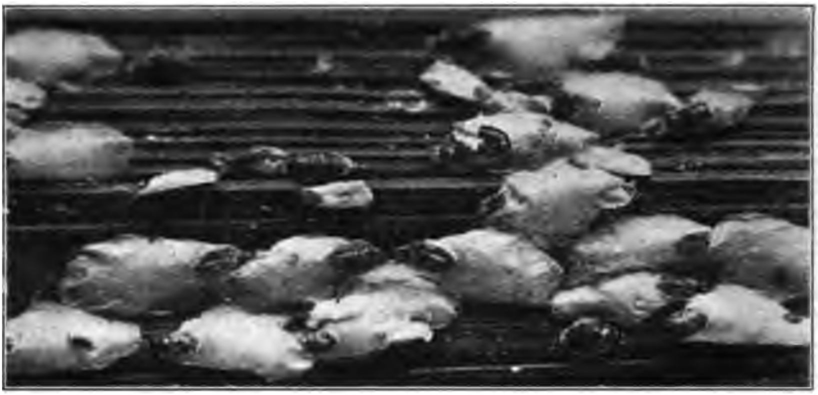
[1] Tech. Series 17, part II, Bureau of Entomology, U. S. Dept. of Agric., 1915.

PLATE I.

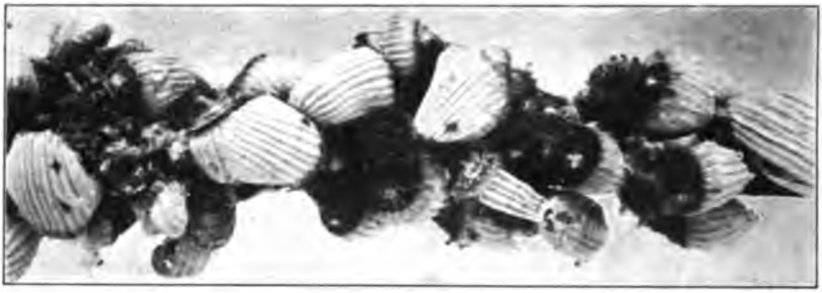


**DANGEROUS SCALE INSECTS.**

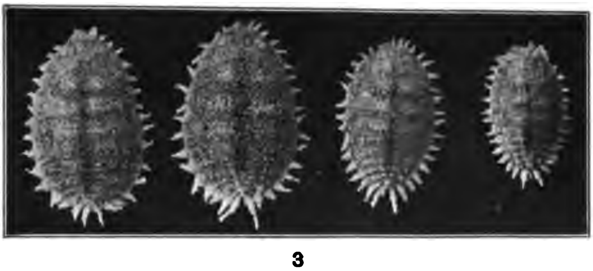
The mango scale (**Leucaspis indica*), upper figures. The hackberry scale (**Lecaniodiaspis celtidis*), lower figures. (Original, Sasscer.)



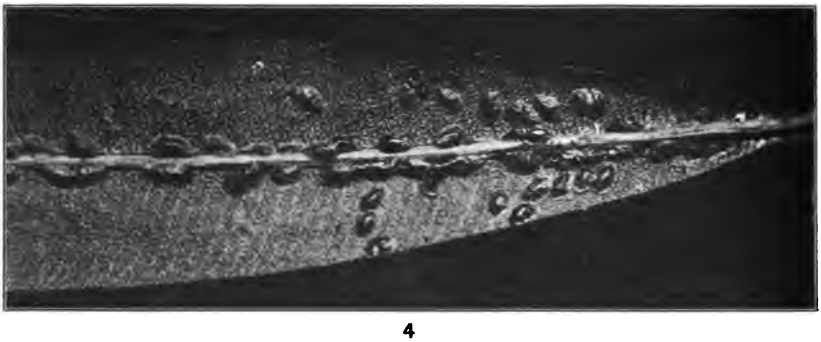
1



2



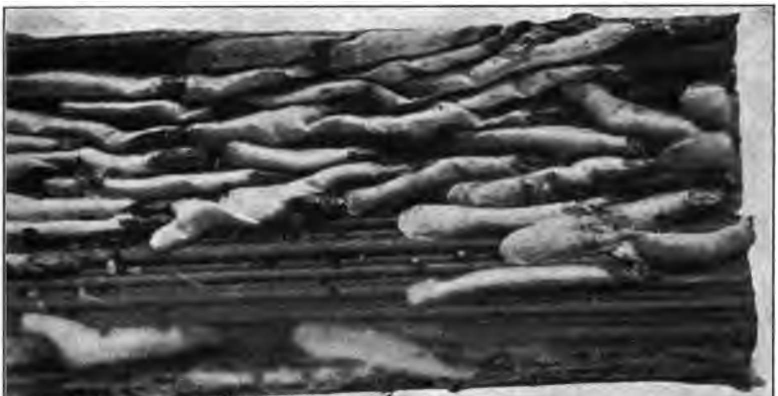
3



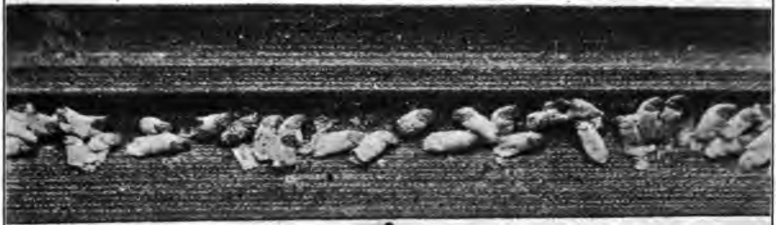
4

## DANGEROUS SCALE INSECTS.

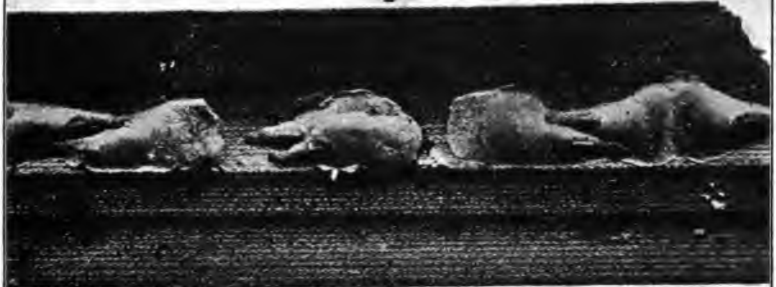
FIG. 1.—The bamboo scale (*Chionaspis graminis*). FIG. 2.—The fluted scale (**Icerya purchasi*). FIG. 3.—The citrus scale (**Pseudococcus citri*). FIG. 4.—**Coccus hesperidum*, a scale of citrus, tea, and palms. (Original, Sasscer.)



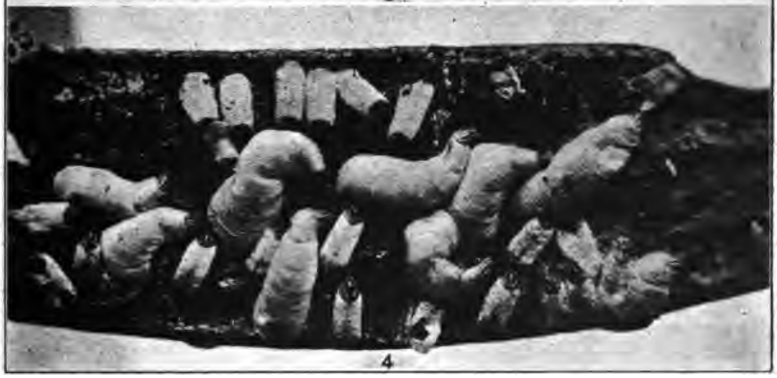
1



2



3

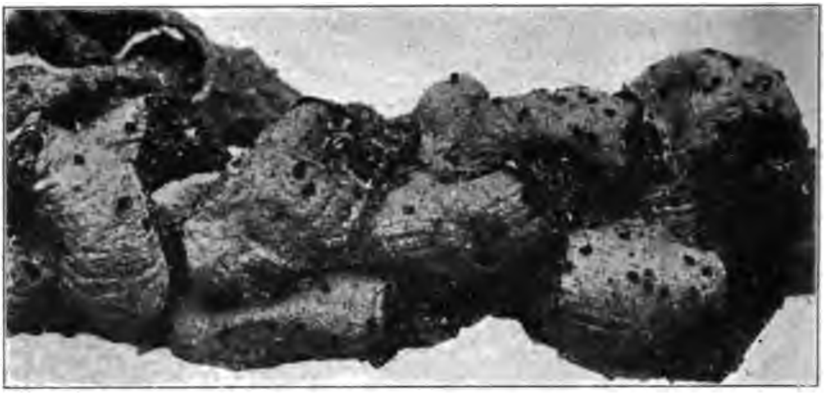


4

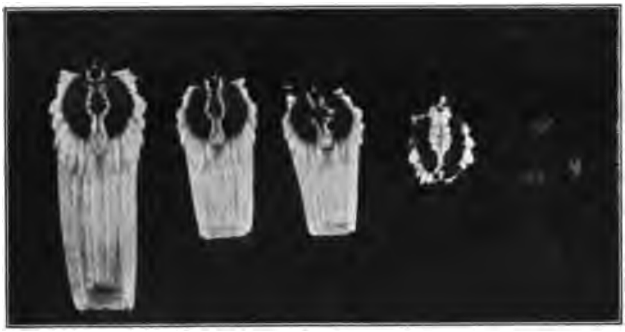
AUSTRALIAN SCALE INSECTS.

FIG. 1.—The cordyline scale (*Leucaspis cordylinidis*). FIGS. 2, 3.—A scale (*Lepidosaphes pallens*), of Xanthorrhoea. FIG. 4.—A scale (*Chionaspis nitida*) of *Daviesia corymbosa*. (Original Sasscer.)

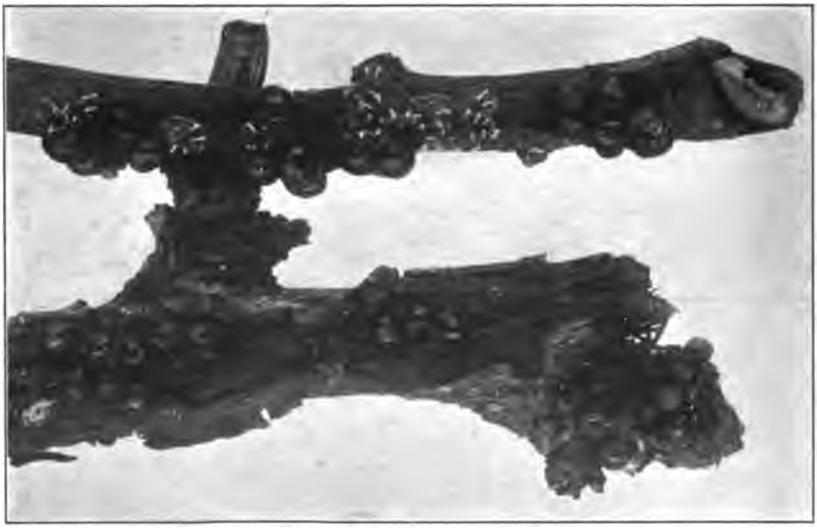
PLATE IV.



1



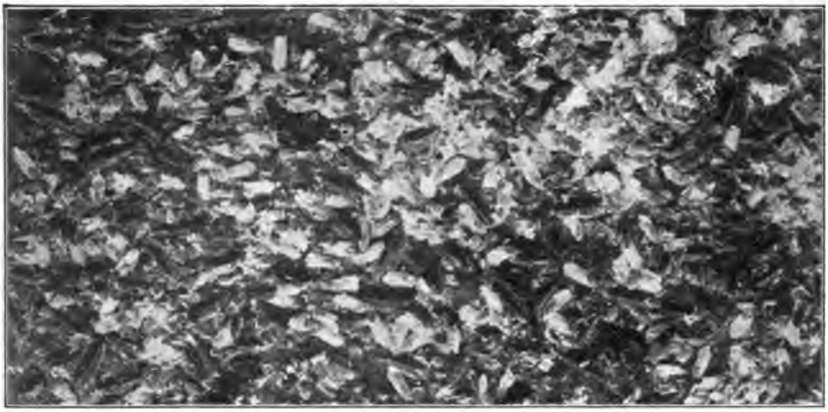
2



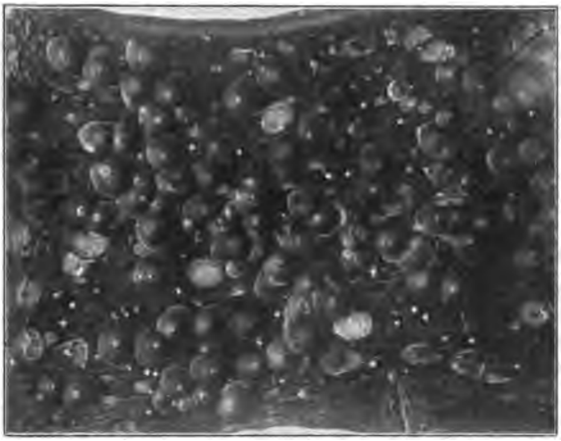
3

DANGEROUS SCALE INSECTS.

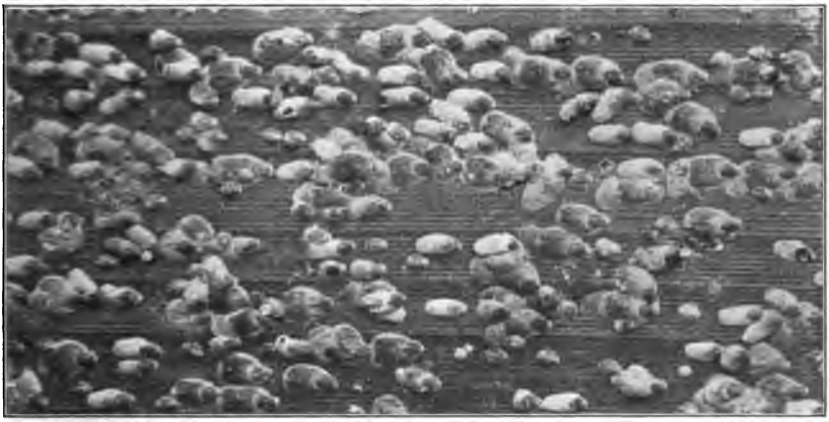
FIG. 1.—The Atriplex scale (*Pulvinaria maskelli*). FIG. 2.—A scale (**Orthezia insignis*) of citrus, tea, etc. FIG. 3.—The plum and peach scale (*Lecanium prunastri*). (Original, Sasscer.)



1



2



3

**DANGEROUS SCALE INSECTS.**

FIG. 1.—The cosmopolitan tea and olive scale (**Fiorinia theae*). FIG. 2.—The Mexican agave scale (*Chrysomphalus agavis*). FIG. 3.—The date palm scale (*Parlatoria blanchardi*). (Original, Sasscer.)

have not been determined or described. For this reason many important species are not included in the present edition.

The larvæ of weevils are white or yellowish with a dark head shield and are usually found in a more or less curved position. Most of them are rather robust and with a very few exceptions have no legs or rudiments thereof.

The pupa can always be distinguished by the presence of the beak lying flattened between the legs.

The adult weevils are distinguished by the prolongation of the head into a beak. This may be very short and broad or very long and slender. They are furthermore characterized by having the tarsi four-jointed. Inspectors are urged to take every possible precaution against the introduction of any species of weevils and where immature or adult stages are found they should immediately place them in alcohol and send them to Washington for determination.

# DANGEROUS FOREIGN INSECTS LIKELY TO BE INTRODUCED IN THE UNITED STATES THROUGH IMPORTATIONS, ARRANGED BY HOST PLANTS.

## ACACIA; WATTLES.

(*Acacia* spp. Family Leguminosæ.)

This genus contains several hundred species distributed throughout the world in semitropical and temperate climates. The gum arabic of commerce is derived from *Acacia senegal;* a drug of commerce is obtained from the wood of *A. catechu;* a soap or hair wash from *A. concinna;* others furnish dyes, fiber, scented wood, or valuable timber. A number of species of this genus or very nearly related to it grow in our Southern States.

### IMPORTANT ACACIA PESTS.

### HEMIPTERA.

**Coccidæ.**

Armored—

- ***Aspidiotus* (*Targionia*) *acaciæ*** Morgan; New South Wales, Tasmania; ***Acacia pycnantha.***
- ***Aspidiotus tasmaniæ*** Green; Australia.
- ***Aspidiotus* (*Pseudaonidia*) *quadriareolata*** Malenotti; Africa; ***A. asak.***
- ***Fiorinia acaciæ*** Maskell; Australia, New Zealand; ***A. pycnantha, A. pulchella, A. longifolia.***
- ***Lepidosaphes acaciæ*** Maskell; Australia; ***A. linifolia.***
- ***Lepidosaphes spinifera*** Maskell; Australia; ***A. pendula.***
- ***Lepidosaphes somalensis*** Malenotti; East Africa; ***A. asak.***
- ***Protodiaspis anomala*** Green; Australia.
- ***Pseudotargionia glandulosa*** Newstead; Egypt; ***A. arabica.***

Unarmored—

- ***Akermes scrobiculatus*** Maskell; Australia.
- ***Akermes levis*** Maskell; Australia; ***A. longifolia.***
- ***Asterolecanium ventruosum*** Maskell; Australia.
- ***Ceroplastes erithræus*** Leonardi; Africa.
- ***Ceroplastes mimosæ*** Signoret; Egypt; ***A. arabica.***
- ***Cryptes baccatus*** Maskell; Australia; ***A. armata, A. calamifolia, A. linearis. A. longifolia. A. melanoxylon***
- ***Epicoccus acaciæ*** Maskell; West Australia; ***A. pulchella.***
- ***Kermes acaciæ*** Maskell; Australia.
- ***Lecaniodiaspis acaciæ*** Maskell; West Australia; attacks ***A. calamifolia, A. cyanophylla, A. microbotrya,*** and ***A. longifolia.***
- ***Lecaniodiaspis africana*** Newstead; Egypt; ***A. arabica.***
- ***Lecaniodiaspis dilatata*** Froggatt; Australia; ***A. discolor.***
- ***Pseudococcus acaciæ*** Maskell; Australia; ***A. linearis, Albizzia lophanta.***

**Coccidæ**—Continued.

Unarmored—Continued.

*Pseudococcus albizziæ* Maskell; Australia, Hawaii; *A. dealbata*, *A. discolor*, *A. baileyana*.

*Pseudococcus farnesianæ* Targioni-Tozzetti; Italy; *A. farnesiana*. This is the huisache of the United States and is here known as *Vachellia farnesiana*.

*Pseudococcus swezeyi* Ehrhorn; Hawaii; *A. koa*.

*Pseudococcus nitidus* Brain; South Africa; *A. caffra*.

*Pseudococcus quaesitus* Brain; South Africa; *A. caffra*, *A. robusta*, *A. horrida*.

*Pseudococcus solitarius* Brain; South Africa.

*Pseudococcus filamentosus* Cockerell; Jamaica, Mauritius, Hawaii, Japan; attacks *A. arabica* in Egypt.

*Rhizococcus lobatulatus*; Australia; *A. pendula*.

*Saissetia mirifica* Maskell; Australia; *A. pendula*.

*Sphærococcus acaciæ* Maskell; Australia.

*Tachardia acaciæ* Maskell; Australia; *A. greggii*.

## COLEOPTERA.

**Buprestidæ.**

*Melobasis splendida* Donovan; Australia; breeds in dead branches of *Acacia longifolia*.

**Scarabæidæ.**

*Diphucephala aurulenta* Kirby; Australia; attacks foliage of black wattle.

*Heterorhina hookeri* White; India; attacks foliage of *Acacia catechu*.

*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus; Europe; larvæ attack roots of seedlings.

*Polyphylla fullo* Linnæus; Europe; larvæ attack roots of seedlings and adults attack foliage.

**Cerambycidæ.**

*Cœlosterna spinator* Fabricius; India; bores in shoots of *A. arabica*.

*Lygesis mendica* Pascoe; Australia; bores in twigs of black wattle.

*Pachydissus sericus* Newman; Australia; breeds in trunks and branches of *A. longifolia*, *A. decurrens*.

*Piesarthrius marginellus* Hope; Australia; breeds in wood of *A. longifolia*.

*Sternotomis bohemani* Chevrolat; German East Africa.

*Symphyletes neglectus*; Australia; girdles branches of *A. longifolia*.

*Symphyletes nigrovirens*; Australia; *A. juniperina*.

*Symphyletes vestigialis*; Australia.

*Uracanthus triangularis* Hope; Australia; attacks branches of black wattle.

*Uracanthus strigosus*, *U. bivittata* and *U. simulans*; Australia; attack *A. longifolia*.

**Chrysomelidæ.**

*Elaphodes tigrinus*; Australia; defoliator.

*Paropsis picea* Oliver; Australia; attack foliage of black wattle.

**Curculionidæ** (sens. lat.).

*Chrysolophus spectabilis* Fabricius; Australia; black wattle.

*Leptops tribulus* Fabricius; Australia; black wattle.

*Rhinotia hæmoptera* Kirby; Australia; breeds in stems of *Acacia suaveolens*.

*Myllocerus acaciæ*; India.

## LEPIDOPTERA.

**Cossidæ.**

*Zeuzera eucalypti* Boisduval, a goat moth; Australia; bores in the thicker branches and trunk of living trees of *Acacia decurrens*.

**Geometridæ.**

*Biston suppressarius* Gn., a defoliator; India; attacks *Acacia catechu*, and *A. modesta*, as well as other trees.

*Euchloris submissaria* Walker, *Lophodes sinistraria* Guer. and *Selidosema lyciaria* Gn. attacks the foliage of black wattle in Australia.

*Selidosema excursaria* and *Thalaina clara* Walker attack the foliage of wattles in Australia.

**Hepialidæ.**

*Pileus hyalinatus* breeds at the roots of wattles in Australia.

*Charagia lignivora* Lewin; Australia. (See Apple.)

**Lymantriidæ.**

*Teia anartoides* Walker, the wattle moth; Australia; skeletonizes foliage. (See Fruit.)

*Teara contraria* Walker; Australia; defoliates.

**Xyloryctidæ.**
*Cryptophaga rubriginosa;* Australia; bores in twigs.

**Tortricidæ.**
*Argyroploce illepida* Buhl.; Australia; India; Ceylon; Africa; attacks seed pods of *Acacia farnesiana.*

HYMENOPTERA.

**Formicidæ** (sens. lat.).
*Camponotus ligniperda* Latreille; an ant; Europe; attacks living wood.

LITERATURE.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
FROGGATT. Australian Insects.
LINDINGER. L. Die Schildläuse (Coccidæ). 1912.
FERNALD, MARIA E. Mass. Agr. Exp. Sta. Bull. 88, 1903.

## ALDER.

(*Alnus* spp. Family Betulaceæ.)

Hardy ornamental trees and shrubs grown in Asia, Europe, North America, and South America. *Alnus rubra* is the most important timber tree. The genus is not attacked by many very serious pests, but any of the wood borers, especially, might become serious when transported to another country in nursery stock. Several pests have gained admission to the United States in some manner. These are indicated by an asterisk.

### A. AN ALDER PEST LIKELY TO BE IMPORTED.

**Coleophora fuscedinella** Zell.

(Alder Bud Moth. Elachistidæ; Lepidoptera.)

*Host:* Alder.

*Injury:* Attacks buds and foliage.

*Description and biology:* *Adult* moth with wing expanse 10–13 mm., forewings dark brownish gray, in the male with a little yellowish; hind wings dark gray. *Egg* overwinters in buds. *Larva* chocolate brown, head and thoracic shield black; third and fourth pairs of prolegs rudimentary. Feeds in buds and on foliage. *Pupates* in case.

*Distribution:* Germany.

NÜSSLIN, Otto. Leitfaden der Forstinsektenkunde, 2d ed., 1913. p. 433.

### B. OTHER IMPORTANT ALDER PESTS.

ACARINA.

**Eriophyidæ.**
*Eriophyes laevis* Nalepa, a blister gall mite; England; on leaves of *Alnus glutinosa.*

ORTHOPTERA.

**Acridiidæ.**
*Podisma alpina* Koll., a green grasshopper of the mountain sections of Europe, Amur, and Japan; very destructive at times.

HEMIPTERA.

**Psyllidæ.**
*Psylla alni* Linnæus, a sucking bug; Germany; breeds on the leaves.

**Coccidæ.**
*Phenacoccus aceris* Signoret; Europe; attacks *Alnus glutinosa*, and *A. incana.*
*Pulvinaria betulae alni* Douglas; England; attacks *Alnus glutinosa.*
*Lecanium capreæ* Linnæus; England.
*Lecanium corni* Bouché; Europe; attacks *Alnus incana.*
*Lecanium coryli* Linnæus; Europe; attacks *A. glutinosa* and *A. incana.*
*Chionaspis salicis* Linnæus; Europe, Egypt; attacks *Alnus glutinosa, A. incana,* and *A. viridis.*
*Hemichionaspis* sp.; Japan.
*Aspidiotis* (*Targionia*) *alni* Marchal; France; attacks *Alnus glutinosa.*

## COLEOPTERA.

**Anobiidæ.**

*Xestobium rufovillosum* De Geer, a brown wood-boring beetle; Europe; injures the wood for technica purposes.

*Ptilinus pectinicornis* Linnæus, a shining dark-brown wood-boring beetle; Europe; injures the wood for technical purposes.

**Buprestidæ.**

**Agrilus viridis* Linnæus, a greenish wood-boring beetle; Europe; bores in the wood of stems and branches. (See Oak.)

*Lampra rutilans* Fabricius (*Pœcilonota*), a yellowish-red wood-boring beetle with greenish or bluish shimmer; Europe; bores in the bast and sapwood of branches.

**Scarabaeidæ.**

*Anomala grandis* Hope, a large bright-green beetle; India; adult strips leaves, larvæ at roots of *Alnus nepalensis*.

*Melolontha hippocastani* Fabricius, a large May beetle; Europe; gnaws roots.

*Melolontha melolontha* Linnæus, a large May beetle; Europe; gnaws roots.

**Cerambycidæ.**

*Oberea linearis* Linnæus, a long-horned wood-borer; Europe; attacks nursery stock especially.

**Chrysomelidæ.**

*Agelastica alni* Linnæus, a blue leaf beetle; Europe; larvæ and adults skeletonize foliage.

*Haltica quercetorum* Foudr., a metallic blue or green leaf beetle; Europe; larvæ and adults skeletonize foliage. (See Oak.)

*Melasoma ænea* Linnæus, a leaf beetle; Europe; larvæ and adults skeletonize leaves.

**Attelabidæ.**

*Apoderus coryli* Linnæus, a long-necked weevil; Europe; adults roll leaves into nests for young.

**Rhynchitidæ.**

*Byctiscus betulæ* Linnæus, a metallic blue or green leaf-rolling weevil; Europe.

*Rhynchites betulæ* Linnæus, a brown or black leaf-rolling weevil; Europe.

**Curculionidæ.**

* *Cryptorhynchus lapathi* Linnæus, a weevil; Europe, and introduced into the United States; bores in young shoots, branches, bark, and wood. It attacks also poplars and willows in the Eastern United States and is an important pest.

*Hylobius abietis* Linnæus, an elongate weevil; Europe; bores in bark of seedlings.

*Orchestes alni* Linnæus, a jumping weevil; Europe; mines the leaves.

*Orchestes testaceus scutellaris* Zetterstedt, a jumping weevil; Europe; mines the leaves.

**Scolytidæ.**

*Anisandrus dispar* Fabricius, a small wood-boring beetle; Germany; breeds in galleries in wood.

*Dryocœtes alni* Georg, a bark beetle; Germany; breeds in galleries in bark and sapwood.

*Trypophlœus alni* Lindemann, a bark beetle; Europe; breeds in galleries in bark and sapwood of *Alnus incana*.

*Xyloterus domesticus* Linnæus, an ambrosia beetle; Germany; breeds in galleries in wood and sapwood.

## LEPIDOPTERA.

**Tortricidæ.**

*Peronea ferrugana* S. V., a greenish leaf-feeding larva; Europe, North America.

**Cossidæ.**

*Cossus cossus* Linnæus, a goat moth; Europe; bores in the wood. (See Willow.)

**Zeuzera pyrina* Linnæus, a white moth; Europe, Africa, North America; bores in the wood. This is an important pest. (See Horse chestnut.)

**Sesiidæ.**

*Sesia culiciformis* Linnæus, a clear-winged moth; Europe; bores in bark and stumps of branches.

*Sesia spheciformis* Gerning, a clear-winged moth; Europe; bores in wood.

**Geometridæ.**

*Anisopteryx æscularia* Schiffermiller, a greenish measuring-worm; Europe; feeds on foliage.

*Larentia dilutata* Borckh., a measuring-worm; Central Europe; feeds on foliage.

**Lymantriidæ.**

*Dasychira pudibunda* Linnæus, the red-tail moth. (See Forest defoliators.)

**Porthetria dispar* Linnæus, the gipsy moth. An important pest in New England. (See Forest defoliators.)

**Notodontidæ.**

*Phalera bucephala* Linnæus, the moon-flecked moth. (See Forest defoliators.)

### HYMENOPTERA.

**Cimbicidæ.**

*Cimbex variabilis* Klg., a sawfly; Europe; breeds on the foliage.

*Trichiosoma lucorum* Linnæus, a sawfly; Europe; breeds on the foliage.

**Tenthredinidæ.**

*Nematus* (*Crœsus*) *septentrionalis* Linnæus, a sawfly; Europe; breeds on the foliage.

*Phyllotoma vagans* Fallén, a sawfly; Europe; breeds on foliage.

**Xiphydridæ.**

*Xiphydrya camelus* Linnæus, a wood wasp; Europe; breeds in the wood.

### LITERATURE.

SORAUER, P.: Handbuch, der Pflanzenkrankheiten 3d ed., vol. 3, by Lindau and Reh, 1913.
NÜSSLIN, OTTO.: Leitfaden der Forstinsektenkunde, 2d ed., 1913.
BARGAGLI, P.: Rassegna Biologica Rincofori Europei, 1883–1887.
LINDINGER, L.: Die Schildläuse (Coccidæ), 1912.

## ALFALFA; LUCERNE.

(*Medicago sativa* Linnæus. Family Leguminosæ.)

Alfalfa is a staple forage plant in many parts of the world, being grown extensively in Europe, Asia, and South America, as well as in this country. Except in shipments of hay, the only danger of introducing pests is with the seed. Some very important European pests of alfalfa have in some manner already reached this country and are doing serious damage.

Most insects attacking clover are potential alfalfa pests and it is therefore advisable to consult the list of clover pests when dealing with alfalfa.

### A. BETTER KNOWN ALFALFA PESTS LIKELY TO BE IMPORTED.

#### **Colaspidema atrum** Olivier.

(Black Alfalfa Leaf Beetle. Chrysomelidæ; Coleoptera.)

*Host:* Alfalfa.

*Injury:* Very serious.

*Description and biology:* A small shining black *beetle* with brownish tint on sides. *Larva* about 6 mm. long, blackish. Oviposits on leaves and tender shoots. The larvæ feed on the foliage and move from field to field in armies. Pupates in the soil.

*Distribution:* Spain, Southern France.

CLARIÓ-SOULÁN, I. V., and COMAS, J. N.: Dos plagas que atacan á los Alcornocales y Alfalfares. Servicio Agron. Nacional Prov. Barcelona, 1911, pp. 9–11.

#### **Hypera murina** Fabricius (**Phytonomus**).

(Alfalfa Leaf Weevil. Curculionidæ; Coleoptera.)

*Hosts:* Alfalfa (*Medicago sativa* L. and *M. s. falcata* L.)

*Injury:* Defoliates, very injurious.

*Description:* Weevil dull brown, oval, about 4 mm., covered with fine gray and brown hairs. Oviposits in stems long rows of eggs. Larvæ feed on the foliage. Pupates in silken cocoon on plant.

*Distribution:* Europe.

BARGAGLI, P. Rassegna Biologica Rincofori Europei, 1883–1887, pp. 94, 95.

### * **Hypera meles** Fabricius (**Phytonomus**).

(Austrian Alfalfa Leaf Weevil. Curculionidæ; Coleoptera).

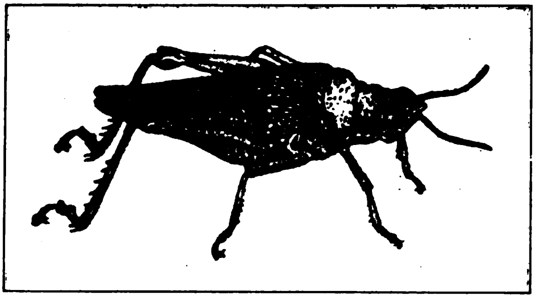


FIG. 1.—*Chrotogonus trachypterus.* An Indian pest of alfalfa. (Maxwell-Lefroy.)

*Hosts:* Alfalfa, Gramnaceæ.

*Injury:* Defoliates.

*Biology:* The larvæ feed on the foliage and spin silken cocoons.

*Distribution:* Europe, and has been recently collected in the United States.

## B. OTHER IMPORTANT ALFALFA PESTS.

### COLLEMBOLA.

**Smynthuridæ.**

*Smynthurus* sp., a springtail, is very injurious to alfalfa in New South Wales, when abundant skeletonizing the fields in moist seasons.

(A. Molineux, Agric. Gaz. N. S. Wales, Nov., 1896, pp. 807–809.)

### ORTHOPTERA.

**Acridiidæ.**

*Chrotogonus trachypterus* Blanchard, a destructive grasshopper of India. (See text fig. 1.)

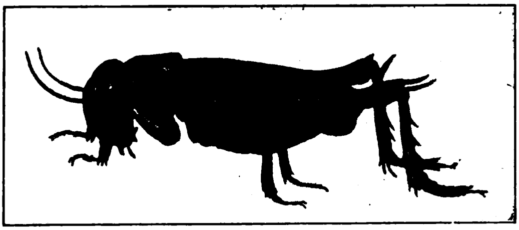


FIG. 2.—*Brachytrypes achatinus.* An Indian pest of alfalfa. (Maxwell-Lefroy.)

**Gryllidæ.**

*Brachytrypes achatinus* Stoll., a brown cricket of India. (See text fig. 2.)

### LEPIDOPTERA.

**Noctuidæ.**

*Prodenia litura* Fabricius, also known as the Egyptian cotton worm, attacks alfalfa in India.

*Plusia nigrisigna* Walker, attacks fruit in India.

* *Chloridea obsoleta* Hübner, the cotton bollworm; * *Agrotis ypsilon* Rott., the greasy cutworm; and * *Laphygma exigua* Hübner, serious pests already in the United States, attack alfalfa in India.

**Tortricidæ.**

*Tortrix divulsana* Walker, the lucerne moth of New South Wales; spins the heads together and feeds on them.

### COLEOPTERA.

**Coccinellidæ.**

*Subcoccinella 24-punctata* Linnæus; Europe; larvæ and adults injure the foliage.

**Cerambycidæ.**

* *Clytus floralis* Pall.; Russia, imported to United States in roots; root borer. (See text fig. 3.)

**Curculionidæ.**

* *Hypera punctata* Fabricius, the clover-leaf weevil of Europe, now common in the United States; also attacks alfalfa.

* *Hypera postica* Gyllenhal, the alfalfa weevil of Europe, introduced into western United States, and very injurious. (See text fig. 4, a–f.)

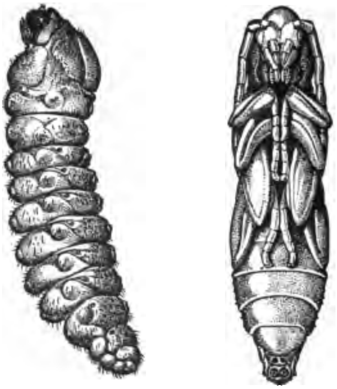


FIG. 3.—*Clytus floralis.* A Russian alfalfa root borer. (Original, Walton.)

*Apion meliloti* Kirby, a tiny weevil; Europe; breeds in the pith of the stems.

*Apion tenue* Kirby, a tiny weevil; Europe; breeds in stems.

**Itonididæ.**

**Asphondylia miki* Wachtl; gall midge; Europe, Arizona; forms galls in seed pods. (See text fig. 5.)

### LITERATURE.

MAXWELL-LEFROY, H. Mem. Dept. Agr. India, Entom. ser. vol. 1, No. 2, June, 1907, pp. 113–252.
SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed. vol. 3, 1913.
BARGAGLI, P. Rassegna Biologica Rincofori Europei, 1883–1887.
WEBSTER, F. M. U. S. Dept. Agric., Bur. Entomology, Bul. 112, 1912.
WEBSTER, F. M. U. S. Dept. Agric., Bur. Entomology, Circ. 147, 1912.

### DIPTERA.

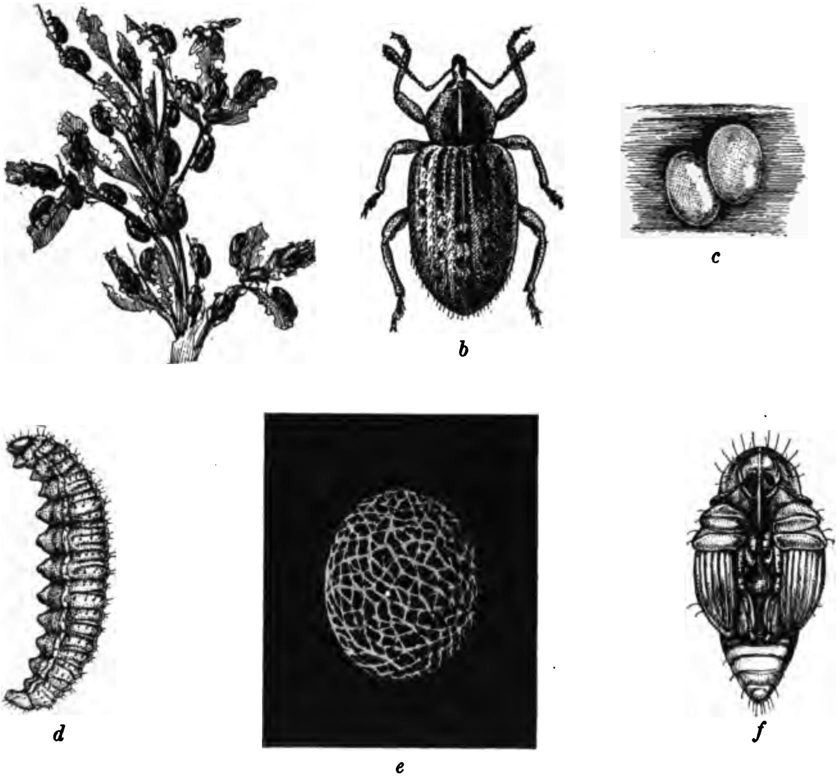


FIG. 4.—Alfalfa weevil (*Hypera postica*): *a*, Adults clustering on sprig of alfalfa; *b*, adult weevil; *c*, eggs; *d*, larva; *e*, cocoon; *f*, pupa. *a*, Natural size; *b*, *d*, *e*, *f*, much enlarged; *c*, greatly enlarged. (Webster.)

## APPLE.

(*Malus malus*, etc. Family Rosaceæ.)

Fruit trees of America, Europe, and Asia, much cultivated in this country.

### A. BETTER KNOWN APPLE INSECTS LIKELY TO BE IMPORTED.

#### Termes australis Hagen.

(The Victorian White Ant. Termitidæ; Isoptera.)

*Hosts:* Apples and other deciduous fruits, orange, Eucalyptus, vines, geraniums, timbers, furniture, books, etc.

*Injury:* Makes galleries in above plants and is also injurious to timbers in houses, furniture, etc.

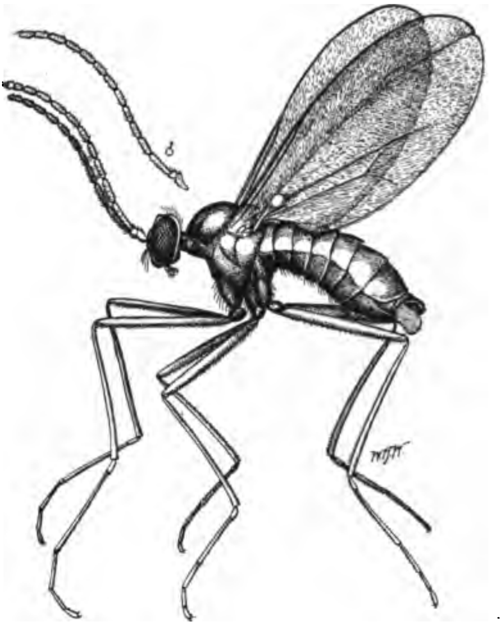


FIG. 5.—The alfalfa gall midge (*Asphondylia miki*): Adult female, with antenna of male above, at left. Greatly enlarged. (Original, Walton.)

*Distribution:* Australia.

FRENCH, C. Handbook of Destructive Insects of Victoria, 1893, pt. 2, pp. 136–144, plate 32.

### Psylla mali Schmidbg.

**(The Apple Psylla. Psyllidæ; Hemiptera.)**

*Hosts:* Apple.

*Injury:* Very injurious in England.

*Description and biology: Adult* 2.5–3 mm. long; color variable from greenish to brownish yellow (some show dark markings, with even red or yellow); wing veins greenish or greenish yellow. *Nymphs* flat, at first yellow or dirty yellow, with brown markings and red eyes, later becoming green all over; body partly covered with white or pale-blue curly waxen threads, and there is a long thread with a waxy globule. *Eggs* creamy yellow, but before hatching are faintly dusty red in color. The winter is passed in the egg stage, the eggs being placed on the spurs, around leaf scars, in cracks, among fine hairs, on the new wood, and elsewhere. The nymphs hatch in spring as the buds begin to open and attack the blossom and leaf buds, often destroying the blossoms and greatly stunting the shoots. (See text fig. 6.)

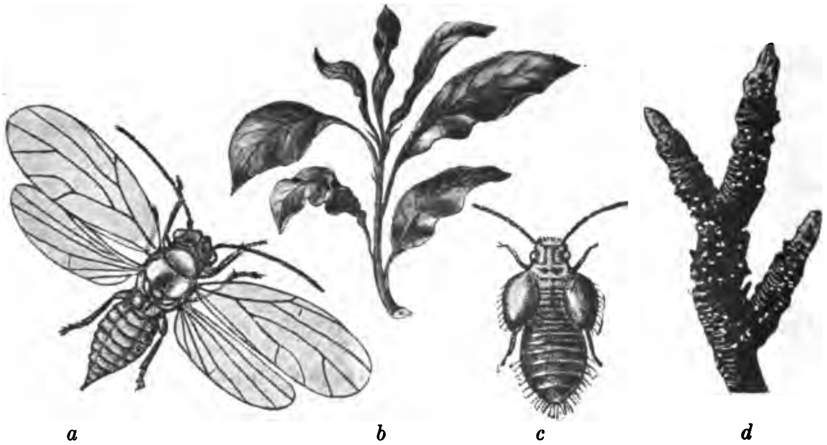
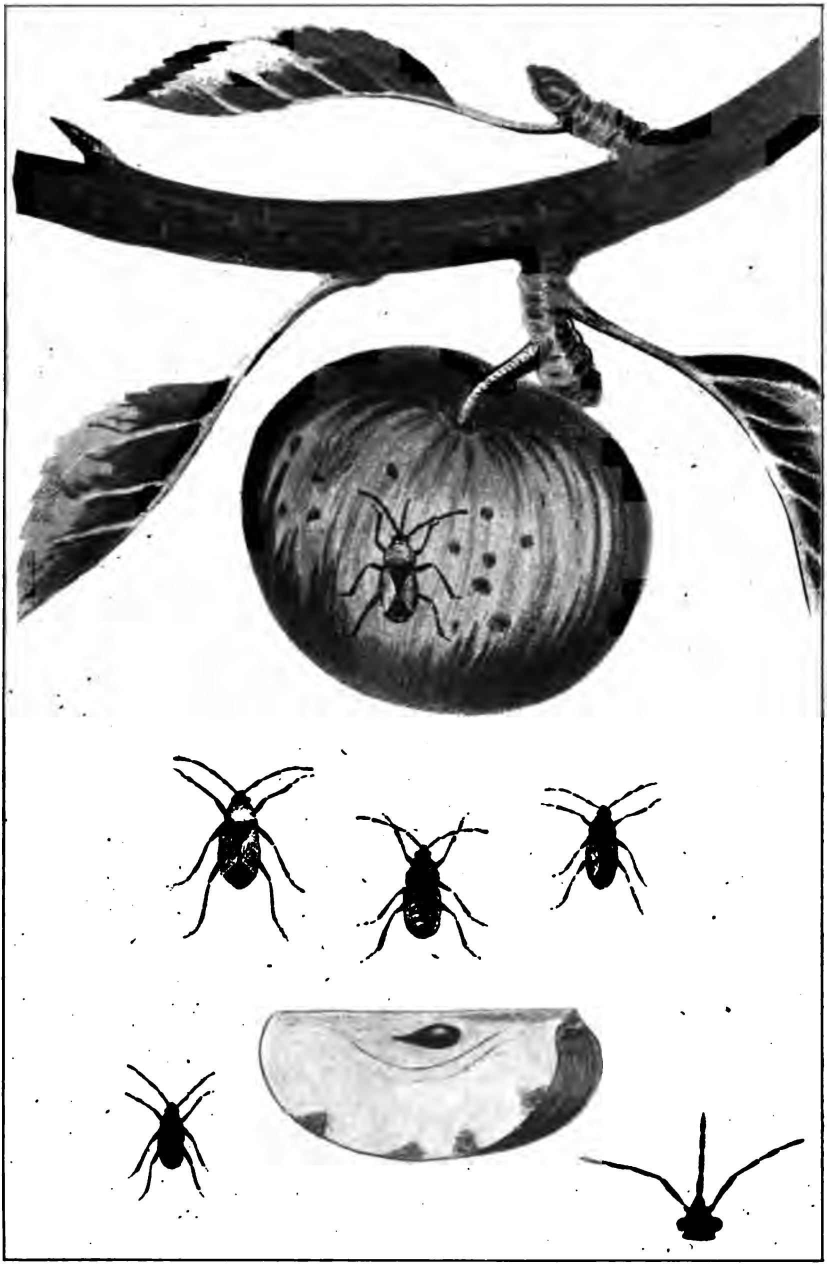


FIG. 6.—Apple psylla (*Psylla mali*): *a*, Adult; *b*, injured twig; *c*, nymph; *d*, eggs on shoot. (Theobald.)

*Distribution:* Europe, Central Russia.

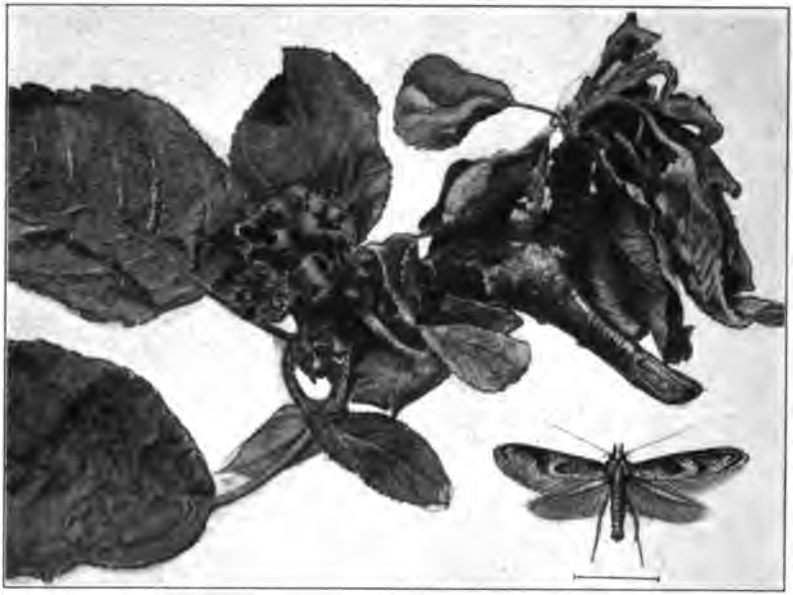
THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 153.



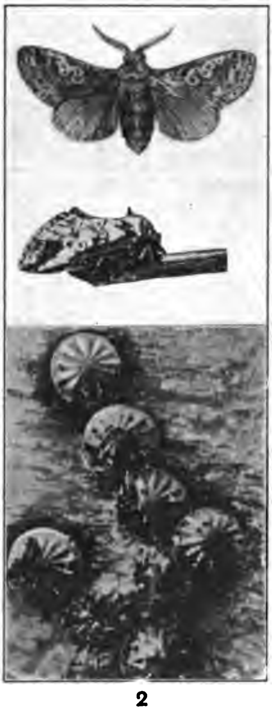
THE HARLEQUIN FRUIT BUG

The harlequin fruit bug (*Dindymus versicolor*): Adults, nymphs, and injury to apple. (French.)

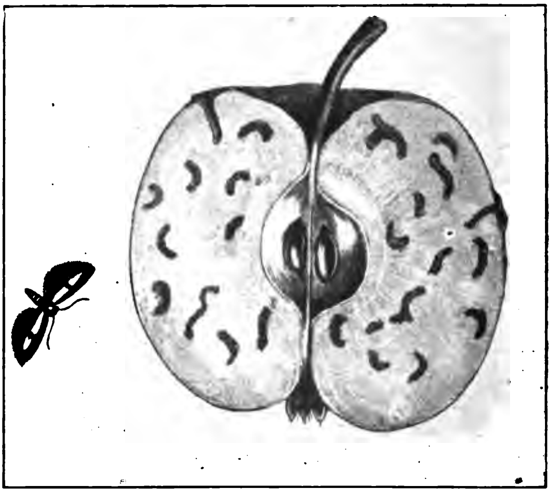
UNIV. OF MIC



1



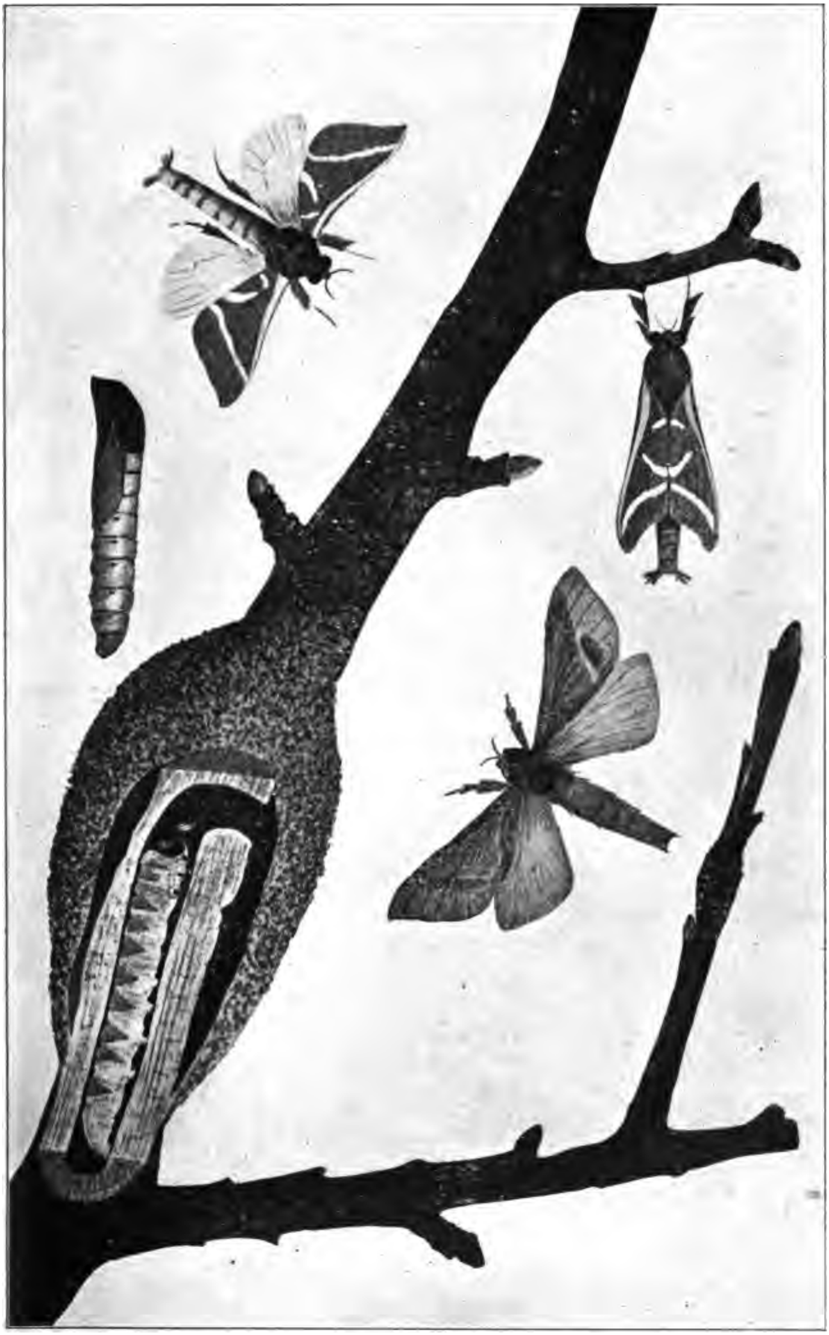
2



3

APPLE MOTHS.

FIG. 1.—The apple pith moth (*Blastodacna hellerella*) and injury to twig and adult. FIG. 2.—The "figure-of-8 moth" (*Diloba cœruleocephala.*) Dorsal and lateral views of adult, and eggs (Theobald). FIG. 3.—The apple moth (*Argyresthia conjugella*). Adult, and injury to apple. (Berettning.)



THE GREEN HANGING MOTH OF THE APPLE.

The green hanging moth of the apple (*Charagia lignivora*): Adults, pupa, and larva in twig showing sawdust swelling. (French.)

**Dindymus versicolor** H.-S.

(Harlequin Fruit Bug. Pyrrhocoridæ; Hemiptera.)

*Hosts:* Apple.

*Injury:* Disfigures apples by puncturing the skin in feeding.

*Description and biology: Adult* about 12 mm. long, orange red, black, and yellow in color. *Nymphs* of both sexes, when about half grown, are more highly colored than when mature. *Eggs* are deposited in late summer among rubbish, crevices of old posts, etc., or even in stubble. The newly hatched nymphs on hot days occur in swarms on many kinds of plants, on fences, and among rubbish. (See plate VI.)

*Distribution:* Australia.

FRENCH, C. Handbook of Destructive Insects of Victoria, 1891, pt. 1, p. 89.

**Rhizopertha collaris** Erichson.

(Apple-tree Borer. Bostrychidæ; Coleoptera.)

*Hosts:* Apple.

*Injury:* Regarded as serious pest.

*Description and biology: Adult* length 4 to 6 mm. Adults bore into wood. *Larva* bores horizontal burrows into wood of trees; remains in tree after it is dead. *Eggs* are deposited in the holes bored in trees.

*Distribution:* Australia, Tasmania.

FRENCH, C. Handbook of Destructive Insects of Victoria, 1891, pt. 1, p. 61.

**Phyllobius maculicornis** Germar.

(Green Leaf Weevil. Brachyrhinidæ; Coleoptera.)

*Hosts:* Apple, pear, cherry, plum, nuts, oak, hawthorn, sloe, maple.

*Injury:* Injury frequent. Attack young buds and leaves.

*Description and biology: Adult* length 12 mm.; brown; clothed with green or greenish scales; slightly hairy; antennæ reddish, with black, clublike apices; legs black and brown. Occurs throughout May and June. *Pupates* in spring. *Larva* white, footless, curved, slightly hairy, with brown hairy head. Feeds on roots of various plants. Winters as larva. *Eggs* deposited in ground.

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 119.

**Leptops hopei** Schönherr.

(Apple-root Borer. Curculionidæ; Coleoptera.)

*Hosts:* Apple, pear, cherry.

*Injury:* Very serious injury. Attacks roots.

*Description and biology: Adult* length 25 mm.; light grayish brown. Occurs just before buds begin to swell. Disappears in December (Victoria). *Pupates* in ground. *Larva* length 25 mm.; whitish; tunnels roots of trees. *Eggs* deposited on upper sides of leaves, which have their edges glued together, hiding the eggs. Deposited in masses of 40 to 50. (See text fig. 7b.)

*Distribution:* Victoria.

FRENCH, C. Handbook of Destructive Insects of Victoria, 1891, pt. 1, p. 71.

**Magdalis barbicornis** Latreille.

(Apple-stem Piercer. Curculionidæ; Coleoptera.)

*Hosts:* Apple, quince, and medlar trees.

*Injury:* To twigs.

*Description and biology: Adult* length 2–2.5 mm.; black; neck-shield without knobs on sides; very thickly punctate, elytra strigose-punctate, the space between punctations ridged. Occurs in June. *Pupates* in gallery in twig under bark. *Larva* burrows in twig, by preference in bark, to the sapwood which is only slightly attacked; the bark becomes reddish-brown and sinks away.

*Distribution:* Europe.

HENSCHEL, G. A. O. **Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 94.**

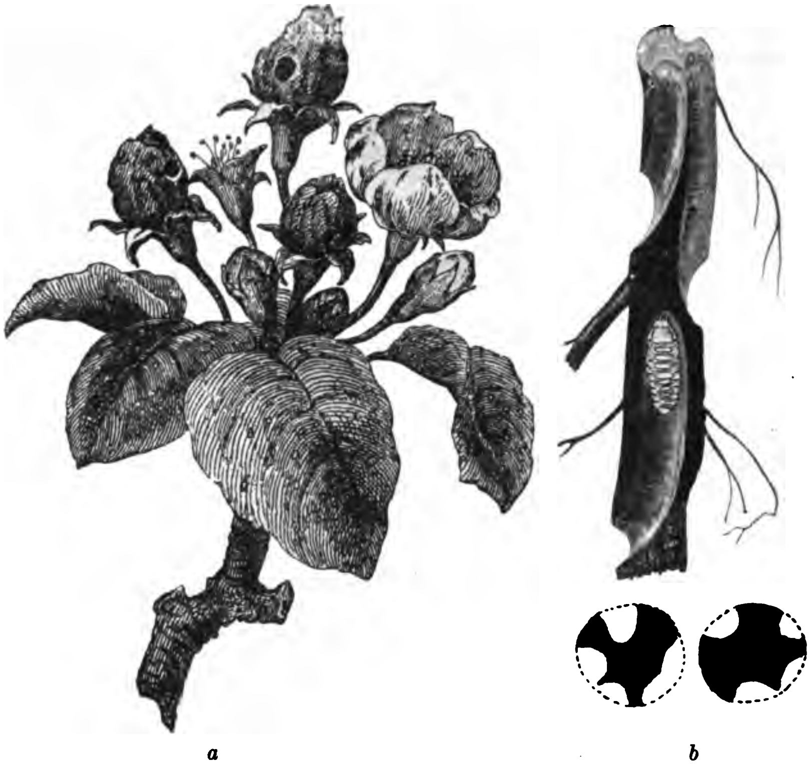


FIG. 7.—Work of apple weevils: *a*, Apple buds injured by *Anthonomus pomorum* (Henschel); *b*, apple root tunneled by *Leptops hopei* (French).

### **Anthonomus pomorum** Linnæus.

(Apple-blossom Weevil. Curculionidæ; Coleoptera.)

*Host:* Apple, pear.

*Injury:* Often very destructive to apple. Larva injurious to buds and blossoms; adult feeds on leaves.

*Description and biology: Adult* length 3 to 4 mm.; pitch black or fuscous black, with ashy pubescence; most easily recognized by pale V-shaped mark on elytra. Appear in late spring and live until next spring, when they copulate and oviposit. Hibernate in rubbish. *Pupa* yellowish brown. Pupates in withered flower bud. Pupation lasts 7 to 10 days. *Larva* length 4–5 mm.; white, footless, head brown; feeds in flower bud. Larval stage 8 days to 3 weeks. *Eggs* deposited in blossom buds. A single female deposits 50 or 60 during a period of 2 weeks. (See text figs. 7a, 8.)

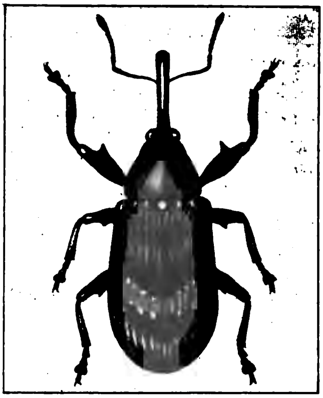


FIG. 8.—Apple bud weevil (*Anthonomus pomorum*). (Theobald.)

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 104.

### Cossus tristis Drury.

(Apple and Quince Borer. Cossidæ; Lepidoptera.)

*Hosts:* Apple, quince, pear.

*Injury:* Bores in sapwood.

*Description and biology: Adult* occurs from September to November (South Africa). Broods may overlap. *Pupa* may be found in July and September. *Larva* length 50 mm.; wholly flesh-colored or mottled with red. Young larvæ feed first beneath the bark, older larvæ burrow in middle wood. *Eggs* deposited on bark, singly or in groups; especially in the fork of branches.

*Distribution:* South Africa.

Lounsbury, C. P. Rept. Gov. Entomologist for 1898. Cape of Good Hope, Cape Town, 1899.

### Blastodacna putripennella Zeller.

(Apple Pith Moth. Elachistidæ; Lepidoptera.)

*Host:* Apple.

*Injury:* Not seriously destructive.

*Description and biology: Adult* forewing brownish gray with golden and whitish spots and stripes, head gray; eyes white; antennæ, gray ringed with white. Occurs in July and August (Germany). *Pupates* about end of June between dry leaves on dead twigs. *Larva* yellowish, with broad reddish segmental divisions; head, neck, anal shield, and feet dark brown; prolegs and a side stripe above the feet yellow. Hatches in autumn and feeds on leaves; on approach of winter bores into buds of 1-year-old twigs; in spring bores into pith of twig. *Eggs* are placed on leaves. (See text fig. 9.)

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 255, figs. 186, 187.

### Blastodacna vinolentella H.-S.

(Pith Moth. Elachistidæ; Lepidoptera.)

*Host:* Apple.

*Injury:* Considerable injury. Larva burrows into buds, shoots, and spurs.

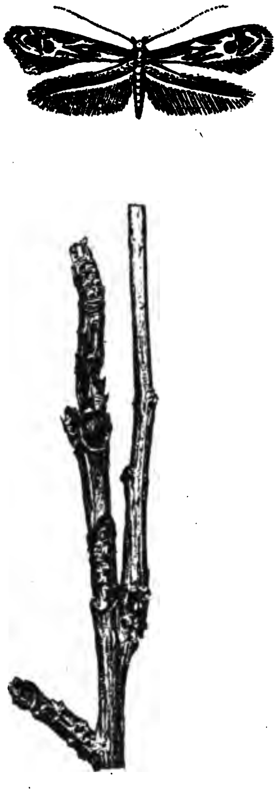


Fig. 9.—Apple pith moth (*Blastodacna putripennella*): Adult and injured twig. (Sorauer.)

*Description and biology: Adult* wing expanse a little less than 12 mm. Forewings may be almost black or may be marked with dark brown and rusty brown; inner margin white to beyond middle, where an irregular faint white oblique bar proceeds to tip of wing; two branches from which intersect black apical portion; hind wings gray and fringed; head black. Occurs in July and August. *Pupa* ochraceous; head, front of thorax, and tip of body, mahogany red; cylindrical in form; length 6 mm. *Larva* length 8 mm. Dull reddish brown with deep brown head and first thoracic segment. Larvæ hatch in late summer, feed on leaves, bore into bud, pass the winter there, and mature in June. *Eggs* are unknown.

*Distribution:* England, Europe.

Theobald, F. V. Insect Pests of Fruit, 1909, p. 92.

### **Blastodacna hellerella** Dup.

(Pth Moth. Elachistidæ; Lepidoptera.)

This moth is similar to *B. vinolentella* in habits and description, except that head of adult is white. (See plate VII, fig. 1.)

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 92.

### **Chloroclystis rectangulata** Linnæus.

(Green Pug Moth. Geometridæ; Lepidoptera.)

*Host:* Apple.

*Injury:* Feeds on blossoms and young leaves. Not serious.

*Description and biology: Adult* wing expanse 18 mm.; forewings deep green with dark brown and gray bands; hind wings with similar greenish tinge. Flies in May, June, and July. *Pupa* thorax and wing cases yellow; caudal end deep red, tinged with olive. *Larva* pale yellowish green, with rusty red line down back; division between segments reddish; a line at sides yellowish green. Larvæ appear in early spring. *Pupate* in earthen cocoon on ground. *Eggs* deposited on trees in early summer, where they remain over winter.

*Distribution:* Europe, England.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 68.

### **Charagia lignivora** Lewin.

(Green Hanging Moth of the Apple. Hepialidæ; Lepidoptera.)

*Hosts:* Apple, acacia, aster, eucalyptus, etc.

*Injury:* Injuries confined largely to native trees; sometimes destructive to apple. Bores in wood.

*Description and biology: Adult* male forewings pea-green, with silvery white markings; hind winds pale green; female forewings darker green than those of male, with purplish bands; hind wings orange pink. *Larva* pale pink, yellow or purplish yellow, head dark-brown. A "swelling" sawdust covering covers burrow of larva. *Eggs* deposited on bark of tree. (See plate VIII.)

*Distribution:* Victoria.

FRENCH, C. Handbook of Destructive Insects of Victoria, 1909, pt. 4, p. 77.

### * **Argyresthia conjugella** Zeller.

(Apple Moth. Hyponomeutidæ; Lepidoptera.)

*Hosts:* Apple, cherry, plum, whortleberry, mountain ash, service berry.

*Injury:* Serious to fruit.

*Description and biology: Moth* with front wings violet gray, sprinkled with lighter, with yellowish white stripe on the inner margin. and a whitish spot near apex. *Larva* with black head. body at first whitish, later fleshy red with many dark brown setigerous spots; 7 mm. long. Breeds in fruits. Pupates outside of the fruit in cocoons. (See plate VII, fig. 3.)

*Distribution:* Europe, British Columbia, Japan.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 269–270, figs. 196–197.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 193.

Report No. 6, Hokaido Agric. Exp. Sta., Sapporo, Japan, March, 1916. Plates 1, 3.

### *Hyponomeuta malinellus Zeller. H. padellus Linnæus.

(Apple and Cherry Ermine Moths. Hyponomeutidæ; Lepidoptera.)

These two ermine moths, which are destructive fruit-tree pests, have recently been introduced into the United States, the one well treated in Technical Bulletin[24, of the Geneva, N. Y., Agricultural Experiment Station (1912), to which the reader is referred. (See text fig. 10.)

### Diloba cæruleocephala Linnæus.

(Figure-of-8 Moth. Blue-head. Noctuidæ; Lepidoptera.)

*Hosts:* Apple, plum, cherry.

*Injury:* Seldom serious; defoliation.

*Description and biology: Adult* wing expanse of male less than 25 mm., female 30 mm.; forewing grayish brown and brown, with a pale spot shaped like a figure 8 on each wing; hind wing grayish brown with darker ray-like lines and a dark wedge-shaped patch at the hinder angle. Occurs in September and October (England). *Larva* over 25 mm. long; head blue with two small black dots; body color varied, yellowish green or bluish gray, with broken yellow line alongside below spiracles; small black spots on segments. Larvæ appear when leaves expand and are ready to spin up in June; pupate in crevvices in bark and on limbs of trees. *Eggs* usually laid singly on shoots and spurs of fruit trees; they are round, flattened below, gray or grayish brown in color. (See plate VII, fig. 2.)

*Distribution:* England, Europe, and Asia Minor.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 35.

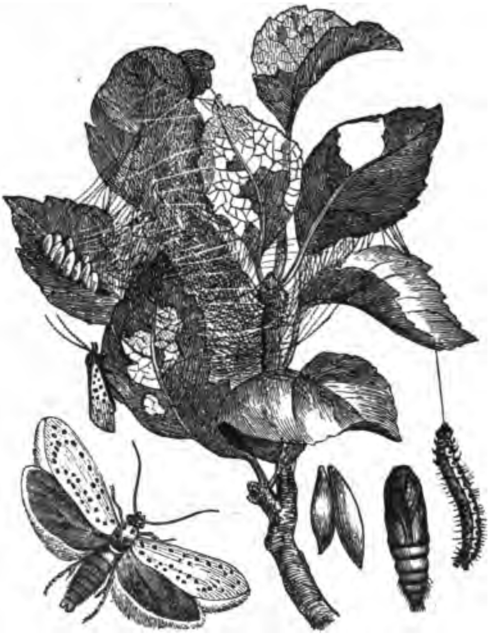


FIG. 10.—Apple ermine moth (*Hyponomeuta malinellus*) Eggs, larva, pupa, adult, and nest. (Henschel.)

### Sesia myopæformis Bosk.

(The Apple Clearwing. Sesiidæ; Lepidoptera.)

*Hosts:* Apple, apricot.

*Injury:* Larvæ work under bark.

*Description and biology: Adult* wing expanse 22 to 25 mm.; head, thorax, and abdomen black; male abdomen has red band above and white beneath; female has only a white edge underneath, with tail-like fan of black scales; wings transparent with dark scaled areas. Day-flying moths; occur in May, June, and July. (England). *Pupa* pale brown, protected by silken cases covered with chips. *Larva* length 15 mm.; dull yellowish white, head reddish brown; second thoracic segment with brown dorsal shield. *Eggs* laid on tree trunk. (See text fig. 12.)

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 17.

### **Tortrix ashworthana Newman.**

(Light Brown Apple Moth. Tortricidæ; Lepidoptera.)

*Host:* Apple. (A. Busck states that this species feeds on Acacia only.)

*Injury:* Very serious; attacks fruit in manner similar to codling moth.

*Description and biology: Adult* female wing expanse, 18 mm.; forewings light brown, slightly barred. *Larva* light green in color, seldom penetrates apple as far as seeds. *Eggs* deposited in calyx.

*Distribution:* Australia.

French, C. Handbook of Destructive Insects of Victoria, 1891, pt. I, p. 66.

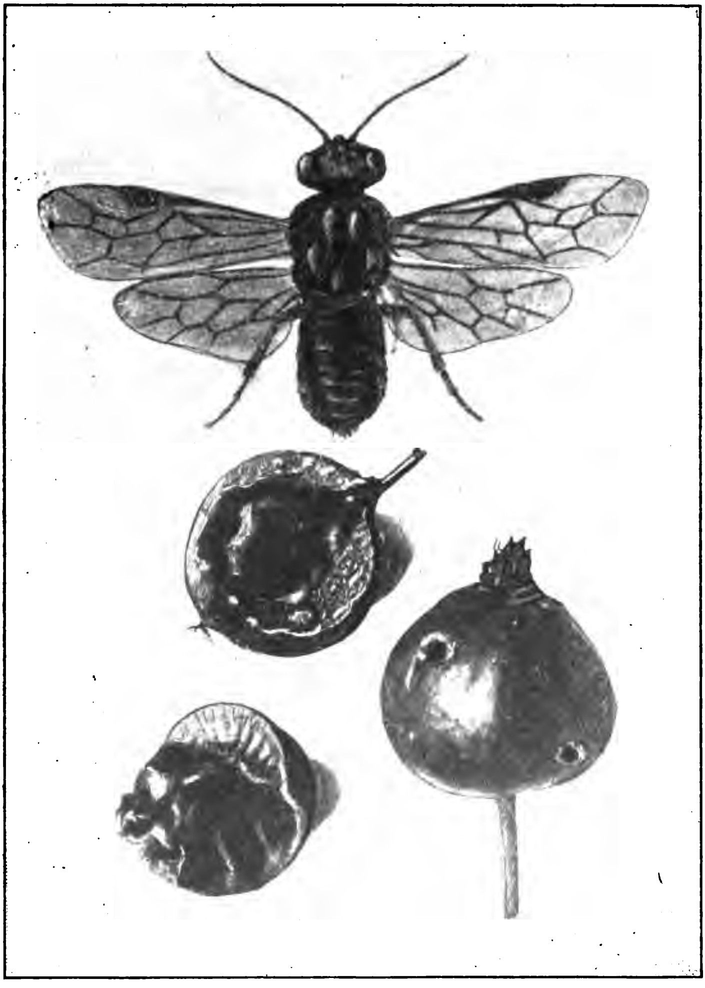


Fig. 11.—The apple sawfly (*Hoplocampa testudinea*). Adult and injured apples. (Theobald.)

**Hoplocampa testudinea** Klug.

(Apple Sawfly. Tenthredinidæ; Hymenoptera.)

*Host:* Apple.

*Injury:* Local. Damages fruit.

*Description and biology: Adult,* female, length 6–8 mm.; reddish yellow, with a black patch on the head, another on thorax and on dorsum of abdomen; head and mesothorax punctured; antennæ dusky in middle: male, slightly smaller. First brood occurs about apple-blossom time; second brood occurs in July. *Pupate* in soil. *Larva,* length 12 mm., creamy white; grub-like with brown head and a double, black chitinous plate on dorsum of anal segment; eats out cavities in interior of fruit. Many larvæ migrate from one apple to another. Larval period in first brood 4 or 5 weeks. Winters as larva in second brood. *Eggs* are deposited in blossom. This stage varies from 8 to 14 days. (See text fig. 11.)

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 122.

## B. IMPORTANT APPLE INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—

*Aspidiotus* (*Diaspidiotus*) *africanus* Marlatt; South Africa.

*Diaspis pyri* Colvée; Spain, Belgium, Denmark, France, Italy, Croatia, Austria, Switzerland, Tyrol.

**Epidiaspis piricola* Del Guercio; France, Russia, Italy. (See Pear.)

**Leucaspis japonica* Cockerell; Japan.

*Parlatoria affinis* Newstead; Algeria, Egypt.

*Parlatoria calianthina* Berlese and Leonardi; Italy, Spain, Victoria, and New South Wales.

**Parlatoria pyri* Marlatt; China; scale of female 1–1.25 mm. in length, oval; larval exuvia, purplish green, second exuvium dark olive, almost black. Apparently a dangerous pest.

Unarmored—

*Coccus hoferi* King; Switzerland.

**Lecanium bituberculatum* Targioni-Tozzetti; England, France, Sweden, Italy, Germany.

*Lecanium capreæ* Linnæus; Europe, Nova Scotia.

*Lecanium glandi* Kuwana; Japan.

**Lecanium persicæ* Fabricius; Europe, Australia, Canada.

*Lecanium pyri* Schrank; Europe, Prince Edwards Island.

*Lecanium rugosum* Signoret; France, Germany.

*Lecanium variegatum* Goethe; Europe.

*Lecanium vini* Bouché; Europe.

*Pseudococcus glaucus* Maskell; New Zealand.

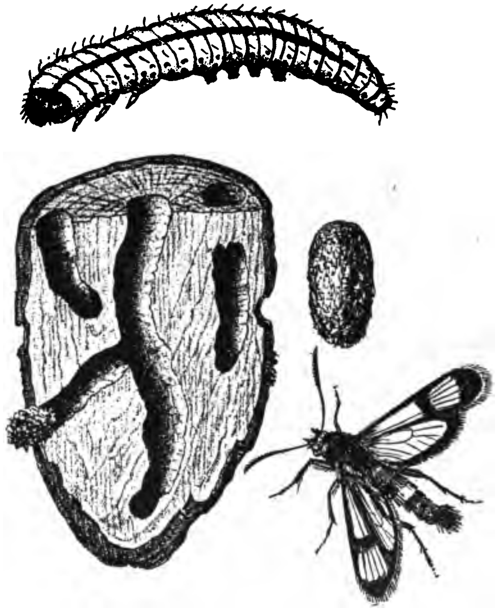


FIG. 12.—The apple clearwing (*Sesia myopæformis*). Moth, cocoon, larva, and borings. (Reichelt.)

**Tingitidæ.**

*Stephanitis pyri* Fabricius; Europe. (See Pear.)

### COLEOPTERA.

**Cerambycidæ.**

*Cerambyx scopolii* Fuessly; Europe; borer.

*Saperda scalaris* Linnæus; Europe; borer.

*Liopus nebulosus* Linnæus; Europe; borer.

**Curculionidæ.**

*Magdalis cerasi* Linnaeus and *M. pruni* Linnæus; Europe; breed under bark.

*Anthonomus incurvus* Panzer, *A. pedicularius* Linnæus, and *A. pyri* Boheman; bud weevils; Europe.

**Anthribidæ.**

*Doticus pestilans* Oliff; Victoria; a pest of dried apples.

**Scolytidæ.**

*Scolytus pruni* Ratzeburg; Europe. (See Plum.)
*Scolytus mali* Bechst.; Europe; galleries in bark.

LEPIDOPTERA.

**Pyralidæ.**

*Dichocrocis punctiferalis* Guénée; Queensland. (See Corn.)

**Lymantriidæ.**

*Teia anartoides* Walker; Australia. (See Fruit.)

**Lasiocampidæ.**

*Gastropacha quercifolia* Linnæus; Europe. (See Fruit.)
*Odonestis australasiæ* Fabricius; Australia; defoliator.

**Geometridæ.**

*Hibernia defoliaria* Clerck; Europe. (See Forests.)
*Anisopteryx æscularia* Schiffermiller; Europe. (See Forests.)
*Cheimatobia brumata* Linnæus.

**Elachistidæ.**

*Coleophora anatipennella* Hübner; Europe. (See Plum.)

HYMENOPTERA.

**Tenthredinidæ.**

*Hoplocampa fulvicornis* Klug, sawfly; Europe; mines in fruit.

DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann. (See Fruit.)
*Bactrocera tryoni* Froggatt; Orient. (See Fruit.)
*Bactrocera cucurbitæ.*

## APRICOT.

(*Prunus armeniaca*, etc.)

Fruit trees of the Orient, now widely cultivated.

### A. AN APRICOT PEST LIKELY TO BE IMPORTED.

**Capua angustiorana** Haworth.

(Small Apricot and Vine Moth. Tortricidæ; Lepidoptera.)

*Hosts:* Apricot, vine, pear and a great variety of other trees. Attacks foliage and fruit clusters.

*Injury:* Does much harm to foliage of wall fruit.

*Description and Biology: Adult* wing expanse 12–18 mm.; female forewing reddish-ochreous, with a reddish brown basal patch forming an oblique streak and a reddish central spot; a costal spot is pale yellow; male wing grayish-ochreous with brown and black markings. Occurs from June until August. Pupation takes place among leaves. *Larva* length more than 12 mm.; color yellowish, or grayish green with pale spots from which arise hairs; occurs in greatest numbers in April and May; rolls leaf. *Eggs* deposited on twigs, hatching in spring.

*Distribution:* Europe, Asia Minor, Africa.

Theobald, F. V. Insect Pests of Fruits, 1909, p. 181.

### B. IMPORTANT APRICOT INSECTS.

HEMIPTERA.

**Coccidæ:**

Armored—
- *Aspidiotus (Diaspidiotus) africanus* Marlatt; South Africa.
- **Epidiaspis piricola* Del Guercio; Germany, Italy, France, established in California.
- *Parlatoria calianthina* Berlese and Leonardi; Italy.

Unarmored—
- *Lecanium coryli* Linnæus; Europe.
- *Lecanium kunoensis* Kuwana; China.
- **Lecanium prunastri* Fonscolombe; Europe, Japan.
- *Lecanium vini* Bouché; Europe.

COLEOPTERA.

**Cerambycidæ.**

*Liopus nebulosus* Linnæus; Europe; borer.

*Uracanthus acutus* Blackburn; Australia. (See Peach.)

**Scolytidæ.**

*Scolytus amygdali* Guérin; Europe. (See Almond.)

LEPIDOPTERA.

**Sesiidæ.**

*Sesia myopaeformis* Bosk.; Europe. (See Apple.)

COLEOPTERA.

**Geometridæ.**

*Lophodes sinistraria* Guérin; Australia; defoliator.

DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann, attacks *Prunus armeniaca.* (See Fruit.)

*Bactrocera tryoni* Froggatt; Orient. (See Fruit.)

*Bactrocera cucurbitæ.*

## ARAUCARIA.

(Family Coniferæ.)

Small evergreen plants much used in horticulture.

### IMPORTANT ARAUCARIA INSECTS.

HEMIPTERA.

**Coccidæ:**

Unarmored—

*Ctenochiton araucariæ* Green; Australia.

*Eriococcus araucariæ* Maskell; Europe, Canary Islands, Brazil; *Araucaria excelsa, A. bidwilii.*

*Eriococcus angulatus* Froggatt; Australia; *Araucaria excelsa.*

*Pseudococcus aurilanatus* Maskell; New Zealand, Australia, Auckland, Natal, Hawaiian Islands; *Araucaria excelsa.*

## ARBORVITÆ.

(*Thuya* spp. Family Juniperaceæ.)

Ornamental evergreen trees of North America, East and Central Asia. The wood is light and soft, brittle, and rather coarse grained, durable in the soil; much used for construction, cabinet making, and in cooperage. *T. occidentalis* contains a volatile oil used in medicine.

### INSECTS INJURIOUS TO ARBORVITÆ.

HEMIPTERA.

**Coccidæ:**

Armored—

* *Chionaspis striata* Newstead; Egypt, Algeria, Arizona, California; attacks *Thuya africana.*

*Diaspis visci* Schrank; Europe; *Thuya occidentalis.*

Unarmored—

*Lecanium arion* Lindinger; Europe; *Thuya occidentalis.*

COLEOPTERA.

**Scolytidæ.**

*Phlœosinus thujae* Perris; Europe.

BIBLIOGRAPHY

Lindinger, L. Die Schildläuse (Coccidæ), 1912.
Eichhoff ,W., Europ. Borkenkäfer, 1881.

## ASH.

(*Fraxinus* spp. Family Oleaceæ.)

Hardy ornamental trees growing in Europe, Asia, and America. These trees are important also for their timber. *F. ornus* exudes a manna. Certain Chinese species yield the Chinese white wax. The various species are generally readily transplanted and hence will be found in nursery stock shipments. They are usually propagated from seed. As several species of insects breed in the seed, care must be taken about introducing seed for planting.

### A. AN ASH PEST LIKELY TO BE IMPORTED.

**Eriophyes fraxini Nalepa.**

(Ash Gall Mite. Eriophyiidæ; Acarina.)

*Host: Fraxinus excelsior, F. viridis.*

*Injury:* Forms galls in flowers, fruit, and leaves. (See text fig. 13.)

*Description and biology:* Four-legged blister mite which causes galls by its feeding. Liable to introduction on nursery stock.

*Distribution:* Europe, Mexico.

Sorauer, P.: Handbuch der Pflanzenkrankheiten, 3d ed., vol. 3, 1913, pp. 127, 128.

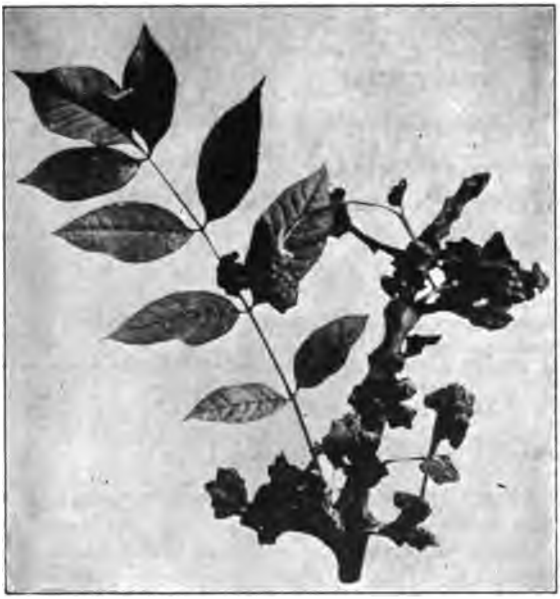


Fig. 13.—Ash gall mite (*Eriophyes fraxini*): Gall formations on twigs of *Fraxinus excelsior*. (Gillanders.)

### B. OTHER IMPORTANT ASH INSECTS.

#### HEMIPTERA.

**Aphididæ.**

*Prociphilus bumeliæ* Schranck, a gall-making louse of Europe, which attacks the tender leaves and petioles of ash and on its intermediate host, the fir, breeds at the roots. The form on fir roots has been known as *Holzneria poschingeri* Holzner.

**Coccidæ.**

Armored—

*Aspidiotus* (*Chrysomphalus*) *nigropunctatus* Cockerell; Mexico.

*Chionaspis salicis* Linnaeus, the willow scale; Europe; attacks *Fraxinus excelsior* and many other trees.

*Parlatoria affinis* Newstead; Algeria; attacks *Fraxinus oxyphylla* and olive.

Unarmored—

*Fonscolombia fraxini* Kaltenbach; Europe; attacks *Fraxinus excelsior*.

#### ORTHOPTERA.

**Oedipodidæ.**

*Pachytylus migratorius* Linnaeus, the migratory locust; Europe; injures many plants.

#### COLEOPTERA.

**Cantharidæ (Meloidæ).**

*Lytta vesicatoria* Linnaeus, the Spanish fly; all Europe; very injurious as adult.

**Cerambycidæ.**

*Cerambyx cerdo* Linnaeus, the great oak borer; Europe; bores in wood. (See Oak.)

**Scarabæidæ.**

*Melolontha hippocastani* Fabricius, a May beetle; Europe; injures the roots of seedlings of various trees.

*Melolontha melolontha* Linnaeus, a May beetle; Europe; injures the roots of seedlings, and the adults attack the foliage.

**Curculionidæ.**

*Cionus fraxini* De Geer, a small oval weevil; Europe; breeds externally on the leaves of ash and olive, pupates in cocoons on the leaf.

**Scolytoidea.**

*Hylesinus crenatus* Fabricius, a bark beetle; Russia, Germany; bores the bark of ash and oak.

*Hylesinus fraxini* Panzer, a bark beetle; Europe; bores the branches and tops, attacking bark of ash, olive, and acacia.

*Hylesinus oleiperda* Fabricius, a bark beetle; Europe; attacks ash and olive.

*Phlœotribus caucasicus* Reitter; a bark beetle; Russia; attacks young portions of the trees.

∗*Scolytochelus multistriatus* Marsh., a bark beetle; Europe; attacks bast and sapwood of trees.

*Scolytus scolytus* Fabricius, a bark beetle; Europe; attacks bark, bast, and sapwood.

LEPIDOPTERA.

**Cossidæ.**

*Cossus cossus* Linnaeus, a goat moth; Europe; bores in the wood. (See Willow.)

∗*Zeuzera pyrina* Linnaeus, a wood borer of Europe, Africa, North America. (See Horse-chestnut.)

**Sesiidæ.**

*Sesia sphecíformis* Grng., a clear-winged moth; Europe; bores in the wood.

**Tortricidæ.**

*Tortrix podana* Sc., a grass-green larva, which occasionally attacks ash; Europe.

**Hyponomeutidæ.**

*Prays curtisellus* Don., a small moth; Europe; larva mines leaves, skeletonizes, webs leaves, or mines buds, in its different generations.

**Gracillariidæ.**

*Gracillaria syringella* Fabricius, a yellowish olive-brown moth; Europe (Sweden); larvæ first mine the leaves and then roll them; attack also *Syringa*.

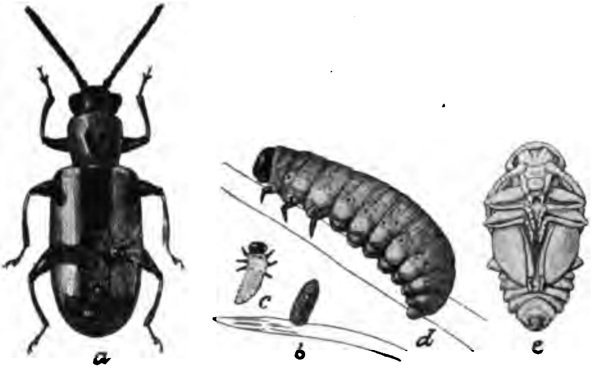


FIG. 14.—Asparagus beetle (*Crioceris asparagi*): *a*, Adult; *b*, egg; *c*, young larva; *d*, full grown larva; *e*, pupa. (Chittenden.)

HYMENOPTERA.

**Tenthredinidæ.**

*Macrophya punctum-album* Linnæus, a saw-fly; England; very injurious.

LITERATURE.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., vol. 3, 1913.

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde 2d ed., 1913.

## ASPARAGUS.

(*Asparagus officinalis* Linnæus. Family Liliaceæ.)

Various other species of asparagus are cultivated for decorative purposes. The above-mentioned species is useful both for its delicious edible shoots and its graceful foliage. Pests introduced on any type of asparagus are likely to attack the cultivated crop.

### A. BETTER KNOWN ASPARAGUS INSECTS LIKELY TO BE IMPORTED.

**Crioceris** spp.

(Asparagus Leaf Beetles. Chrysomelidæ; Coleoptera.)

*Species:* ∗*C. asparagi* Linnæus; Europe, introduced into North America and widely distributed; asparagus. (See text fig. 14) A very important pest. ∗*C. 12-punctata* Linnæus; Europe, introduced into North America and widely distributed; asparagus. (See text fig. 15.) A very important pest. *C. merdigera* Linnæus; Europe; onion, leek, garlic, lily of the valley, asparagus.

*Injury:* Feed on the stems of the asparagus and cause much injury, amounting often to thousands of dollars.

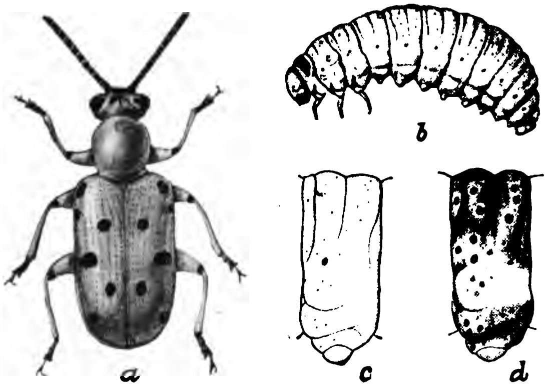


FIG. 15.—Asparagus beetle (*Crioceris duodecimpunctata*): *a*, Adult; *b*, larva; *c*, *d*, details of larval structure. (Chittenden.)

*Biology:* Eggs laid on plant. Larva feeds on stems and foliage. Pupates in soil. Two broods per annum.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., vol. 3, 1913, p. 510.

CHITTENDEN, F. H. U. S. Dept. Agr., Bur. Entomology, circ. 102, 1908, 12 pp., 6 figs.

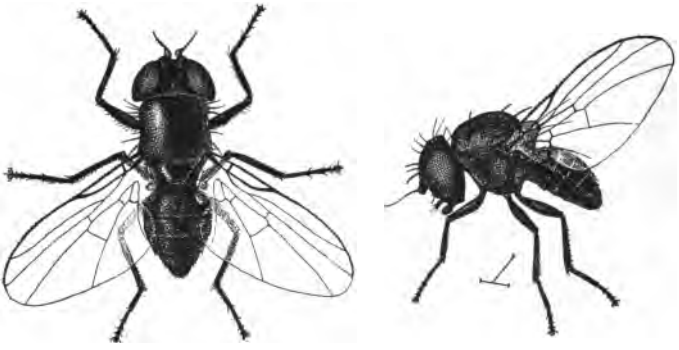


FIG. 16.—Asparagus miner (*Agromyza simplex*): Adults. (Chittenden.)

**Agromyza maura** Meigen. * **Agromyza simplex** Loew.

(Asparagus Miners. Agromyzidæ; Diptera.)

*Hosts:* Asparagus.

*Injury:* Mine immediately under the bark of the asparagus stem. The latter species has been introduced into the United States.

*Description and biology:* Adult fly very small. *Larva* white, legless. *Pupates* in mine. (See text figs. 16, 17.)

*Distribution: A. maura;* Hungary. *A. simplex;* Europe, North America.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, p. 406, 407, fig. 252.

CHITTENDEN, F. H. U. S. Dept. Agr., Bur. Ent., bull. 66, pt. I, 1907, pp. 1–5, 2 figs.

**Platyparæa pœciloptera** Schrank.

(Asparagus Fly. Trypetidæ; Diptera.)

*Hosts:* Asparagus.

*Injury:* Mines the stems.

*Description and biology: Fly* dark brown, abdominal segments banded whitish; face, legs, and antennæ reddish yellow; wings clear with a dark zigzag longitudinal band; length 6–8 mm. *Maggot* whitish, apical stigmatal plates shining black with two forward turned hooks; length 10 mm.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., vol. 3, 1913, p. 421 422.

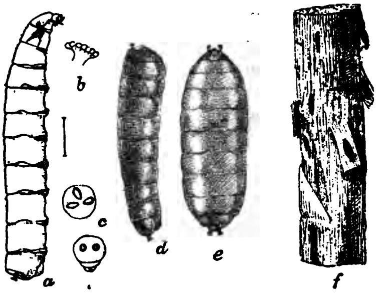


FIG. 17.—Asparagus miner (*Agromyza simplex*): *a*, Larva; *b*, *c*, larval details; *d*, *e*, puparium; *f*, injury. (Chittenden.)

### B. OTHER IMPORTANT ASPARAGUS PESTS.

HEMIPTERA.

**Coccidæ:**

Armored—

*Chionaspis berlesei* Leonardi; Europe; attacks *Asparagus acutifolius* and *A. umbellatus.*

COLEOPTERA.

**Brachyrhinidæ.**

*Cneorhinus plagiatus* Schall.; a weevil, causes serious injury in England.

LEPIDOPTERA.

**Noctuidæ.**

*Mamestra oleracea* Linnæus; Europe; larvæ feed on plants. (See Cabbage.)

DIPTERA.

**Anthomyiidæ.**

*Chortophila cilicrura* Rondani; Europe; breeds in stems. (See Onion.)

## ASSAM RUBBER.

(*Ficus elastica.* Family Urticaceæ.)

Assam or India rubber is a native of Assam and the Malay region. It can be grown from cuttings or seed. As it belongs to the same genus of plants as the fig, its insects are treated under the discussion of that plant. (See Fig.)

## ASPEN.

(*Populus tremula.* Family Salicaceæ.)

*See* Poplar.

## AVOCADO; ALLIGATOR PEAR.

(*Persea gratissima, etc.* Family Lauraceæ.)

This tropical American species is much prized for its large edible fruit, and is now cultivated extensively in Florida and southern California. Several other species of the genus are prized by the American trade for their evergreen foliage.

## A. AN AVOCADO PEST LIKELY TO BE IMPORTED

### Heilipus lauri Boheman.

(Avocado Weevil. Curculionidæ; Coleoptera.)

*Host:* Fruit of *Persea persea* L. (*Laurus drymifolia*) and *Persea pittieri* Mez.

*Injury:* Larvæ make galleries in the seed. Liable to be introduced in seed and fruit. Live specimens have been received in the United States.

*Description:* Adult weevil of a red ground color, with red femora, or dark brown with unicolorous legs and prominent patches of white scales; rostrum long, prothorax conical. The larvæ breed in the seed and their presence is not easily detected. In the case of the recent introductions the seeds were planted and the injury was not noticed until faulty germination caused an examination.

*Distribution:* Mexico, Costa Rica. (See plate XLIX.)

Barber, H. S. Proc. Ent. Soc. Wash., vol. 14, 1912, pp. 181–183, plate 9.

## B. OTHER IMPORTANT AVOCADO INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—

*Aspidiotus* (*Pseudaonidia*) *articulatus* Morgan; Mexico (See Coffee). Scale of adult female 1 mm. in diameter, circular, reddish brown with central portion blackish, exuvia covered.

* *Aspidiotus* (*Chrysomphalus*) *perseæ* Comstock; Mexico.

*Aspidiotus persearum* Cockerell; Hawaii; on *Persea gratissima*. Scale of female 1.25 mm. long, 1 mm. broad brownish cream color, exuvia sublateral.

*Aspidiotus* (*Chrysomphalus*) *personatus* Comstock; West Indies, Mexico; *Persea americana*. (See Olive.)

*Aspidiotus* (*Chrysomphalus*) *scutiformis* Cockerell; Mexico, Central America. (See Citrus.)

*Lepidosaphes longula* Leonardi; Java; scale of female about 2.35 mm. long, elongate, curved, narrow, coffee colored.

*Pinnaspis rhombica* Leonardi; Java; scale of adult female 1 mm. long, rhomboid, castaneous brown.

*Pseudoparlatoria parlatorioides* Comstock; Brazil, Mexico; on *Persea carolinensis*. Scale of adult female about 1.4 mm. in diameter, light yellow, exuvia very large, extending from center of scale to margin, having the appearance of a *Parlatoria*.

Unarmored—

*Ceroplastes cistudiformis* Townsend and Cockerell; Mexico; wax scale. Adult female covered with dirty gray wax which is marked into plates; 6–8 mm. in length and 4.5 to 5.5 mm. in width.

*Ceroplastes rubens* Maskell; Australia, India, Ceylon, Hawaii. Adult female 2.2–6 mm. in length, covered with wax which is rather thick and dull red or pinkish throughout.

*Icerya montserratensis* Riley and Howard; Mexico. (See Citrus.)

*Pseudococcus virgatus* Cockerell; Isle of Pines.

*Pulvinaria mammeæ* Maskell; Hawaii, Natal; on *Persea persea*. Adult female reddish brown covered with a thin grayish meal, ovisac large, snow white, irregular, forming a mass of loose cotton.

*Pulvinaria simulans* Cockerell; Mexico.

### LEPIDOPTERA.

**Lasiocampidæ.**

*Suana concolor* Walker; Java, defoliator.

**Cossidæ.**

*Zeuzera coffeæ* Nietner; India, Ceylon, Java, East Africa, Kamerun. (See Coffee.)

### COLEOPTERA.

**Bostrychidæ.**

*Apate monachus* Fabricius; Africa, West Indies. (See Citrus.)

**Brachyrhinidæ.**

*Diaprepes abbreviatus* Linnæus; West Indies. (See Sugar cane.)

**Calandridæ.**

* *Caulophilus latinasus* Say; Florida, probably imported; bores in seed.

### DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann; attacks *Persea persea*. (See Fruit.)

## BAMBOO.

(*Bambusa* spp.; *Dendrocalamus strictus*, etc.; *Arundinaria* spp.; *Cephalostachyum pergracile; Melocanna bambusioides; Phyllostachys* spp. Family Bambuseæ.) Treelike grasses much used in cultivation.

### A. BETTER KNOWN BAMBOO INSECTS LIKELY TO BE IMPORTED.

**Dinoderus minutus Fabr.**

(Smaller Bamboo Shot-hole Borer. Bostrychidæ; Coleoptera.)

*Hosts:* Bamboo (*Dendrocalamus strictus* and *Bambusa*).

*Injury:* Commonly found attacking bamboos and is also found in cut sugar cane.

*Description and biology: Beetle* brown, shining, 2.5 mm. long, with black head and thorax, the bases of elytra lighter colored, occasionally almost reddish. *Larva* pale canary yellow, opaque, curved; head small orange brown with black mandibles; legs three-jointed. Length 3 mm. Bores in the bamboos. (See text figs. 18, 19.)

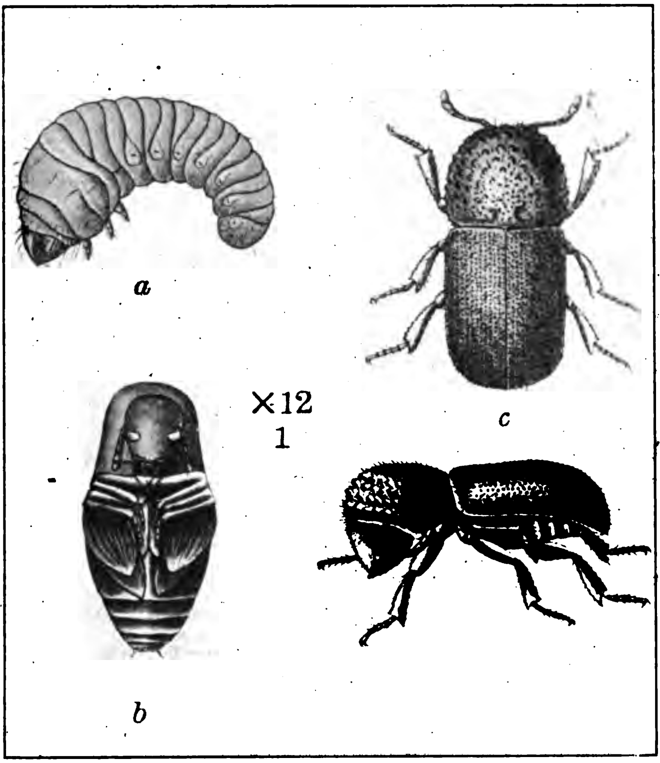


FIG. 18.—Smaller bamboo shot-hole borer (*Dinoderus minutus*): *a*, Larva; *b*, pupa; *c*, adults. (Stebbing.)

*Distribution:* India.

STEBBING, E. P. Indian Forest Insects, Coleoptera, 1914, pp. 133–143, pl. 9.

**Dinoderus pilifrons Lesne.**

(Bamboo Shot-hole Borer. Bostrychidæ; Coleoptera.)

*Hosts:* Bamboo (*Dendrocalamus strictus*), various kinds of wood.

*Injury:* Bores in bamboos.

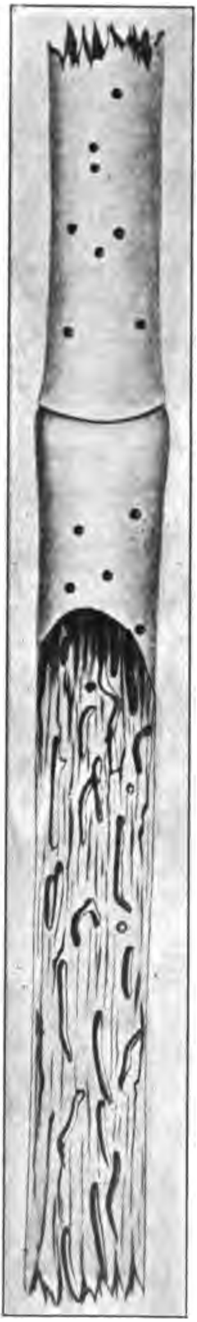


FIG. 19.—*Dinoderus minutus.* Injury to bamboostalks. (Stebbing.)

*Description and biology: Adult* reddish brown, 3.3 mm. long, appendages and lateral edges of abdomen lighter colored. *Larva* yellowish white, mouth parts brownish, mandibles black; length 3.2 mm. *Pupa* with yellow abdomen, wings white, head and prothorax dirty white.

*Distribution:* India.

STEBBING, E. P. Indian Forest Insects, Coleoptera, 1914, pp. 130–133, fig. 89, pl. 131.

### **Eucosoma paragramma** Meyrick.

(Bamboo Borer. Tortricidae; Lepidoptera.)

*Host:* Bamboo.

*Biology: Caterpillar* bores in the stem of green bamboo, pupates in tunnel.

*Distribution:* India.

MAXWELL-LEFROY, H. Indian Insect Life, 1909, p. 530.

### **Ceratitis striata** Froggatt.

(Bamboo Fruit Fly. Trypetidæ; Diptera.)

*Host:* Bamboo shoots.

*Injury:* Larvæ feed in decayed shoots of bamboo.

*Description: Adult* length 5–6 mm., color pale yellow to grayish with upper surface of thorax variegated with black. (See plate XXVI, fig. *a.*)

*Distribution:* Ceylon.

FROGGATT, W. W. Dept. Agric., New South Wales, Farmers' Bull. 24, 1909, p. 51.

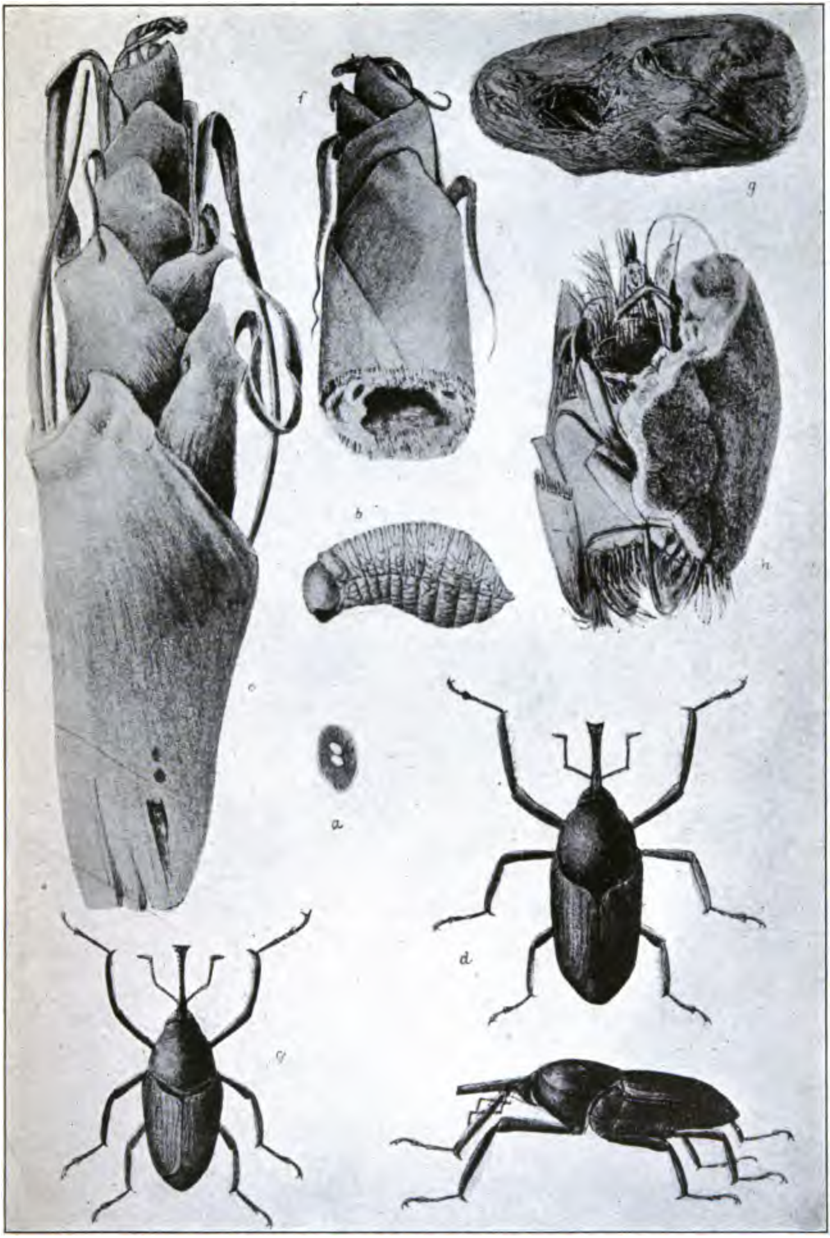
## B. IMPORTANT BAMBOO INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—

_Aspidiotus_ (_Odonaspis_) _bambusarum_ Cockerell; Japan.
_Aspidiotus_ (_Odonaspis_) _canaliculata_ Green; Ceylon.
_Aspidiotus_ (_Odonaspis_) _inusitata_ Green; Japan, Ceylon; _Arundinaria, Phyllostachys bambusoides._
*_Aspidiotus_ (_Odonaspis_) _secreta_ Cockerell; Hawaii, Japan; _Bambusa_ and _Arundinaria._ Has been taken in quarantine at San Francisco.
_Aspidiotus_ (_Odonaspis_) _secreta saccharicaulis_ Zehntner; Java.
_Aulacaspis javanensis_ Newstead; East Java.
_Chionaspis arundinariæ_ Green; Ceylon; _Arundinaria._
_Chionaspis bambusæ_ Cockerell; Japan.
_Chionaspis colemani_ Kuwana; Japan; _Phyllostachys bambusoides._
_Chionaspis elongata_ Green; Ceylon.
_Chionaspis graminis_ Green; Ceylon, Japan. (See Pl. II, fig. 1.)
_Chionaspis hikosani_ Kuwana; Japan; _Phyllostachys bambusoides._
_Chionaspis simplex_ Green; Ceylon.
_Fiorinia bambusæ_ Maskell; Hongkong, China; _Bambusa fortunei._
_Fiorinia diaspiformis_ Newstead; Java.
_Fiorinia signata_ Maskell; Japan; _Bambusa tessellata._
_Fiorinia tenuis_ Maskell; Japan; _Bambusa._
_Hemichionaspis scrobicularum_ Green; Ceylon.
_Lepidosaphes bambusicola_ Cockerell; Brazil.
_Leucaspis bambusæ_ Kuwana; Japan; _Phyllostachys._
*_Leucaspis japonica_ Cockerell; Japan.
_Pinnaspis bambusæ_ Cockerell; Jamaica.



THE BAMBOO BORER.

The bamboo borer (*Cyrtotrachelus longipes*): Adults ,eggs, larva, cocoon, injury. (Stebbing.)

UNIV

**Coccidæ**—Continued.
Unarmored—
*Aclerda distorta* Green; Ceylon.
*Aclerda japonica* Cockerell; England (in greenhouses); *Arundinaria japonica.*
*Aclerda tokionis* Cockerell; Japan; *Bambusa.*
*Antonina socialis* Newstead; England (in greenhouses); *Arundinaria japonica.*
* *Antonina crawii* Cockerell; Japan; California; New Jersey.
* *Asterolecanium bambusæ* Boisduval; Guatemala; Florida; *Bambusa viridis, Bambusa viridi-striata.*
*Asterolecanium coronatum* Green; Ceylon; *Dendrocalamus giganteus.*
*Asterolecanium solenophoroides* Green; Ceylon.
*Asterolecanium exiguum* Green; Ceylon, Hawaiian Islands.
*Asterolecanium flavociliatum* Green; Ceylon; *Arundinaria.*
*Asterolecanium lanceolatum* Green; Ceylon; *Arundinaria.*
*Asterolecanium miliaris* Boisduval; Ceylon, Cuba, Algeria, Mauritius, Brazil, Jamaica, Trinidad; *Bambusa vulgaris, B. distorta, B. oliveriana.*
*Asterolecanium pudibundum* Green; Ceylon.
*Asterolecanium rubrocomatum* Green; Ceylon.
*Asterolecanium tenuissimum* Green; Ceylon.
*Asterolecanium tumidum* Green; Ceylon.
*Asterolecanium udagamæ* Green; Ceylon.
*Asterolecanium bambusicola* Kuwana; Japan.
*Asterolecanium hemisphaericum* Kuwana; Japan.
*Asterolecanium masuii* Kuwana; Japan.
*Ceroplastes theobromæ* Newstead; Cameroon.
* *Chætococcus bambusæ* Maskell; Hawaii, Ceylon, India, Mauritius, Brazil; *Bambusa tulda.*
*Coccus arundinariæ* Green; Ceylon; *Arundinaria.*
*Eriococcus graminis* Maskell; China, Japan.
*Eriococcus onukii* Kuwana; China, Japan; *Arundinaria hindsii* var. *graminæ.*

**Pentatomidæ.**
*Ocrophara montana,* a sucking bug; India; feeds in all stages on the seeds of bamboo (*Dendrocalamus strictus*).

## COLEOPTERA.

**Bostrychidæ.**
*Bostrychopsis parallela;* India; bores in wood of *Dendrocalamus strictus.*
* *Dinoderus brevis* Horn, India; United States; very important borers in the stalks of *Dendrocalamus strictus.*
*Heterobostrychus unicornis* Waterhouse; *Sinoxylon anale* Lesne; bores in bamboos of *Dendrocalamus strictus.*
*Dinoderus distinctus* Lesne; India; bores bamboos. (See Mango.)

**Lyctidæ.**
*Lyctus spinifrons* Lesne; India; bores in bamboos of *Dendrocalamus strictus.*

**Cucujidæ.**
*Psammœcus trimaculatus* Motschulsky; India; bores in wood of *Dendrocalamus strictus.*

**Tenebrionidæ.**
* *Tribolium confusum* Duval, and *T. castaneum* Herbst; India; bore in wood of *Dendrocalamus strictus.*

**Chrysomelidæ.**
*Estigmena chinensis* Hope; India; bores in young stems of *Dendrocalamus strictus* and *Cephalostachyum. pergracile.*

**Cerambycidæ.**
*Stromatium barbatum* Fabricius; India; bores in *Dendrocalamus strictus.*

**Curculionidæ.**
*Cyrtotrachelus dux* Boheman; India; bores in tops and shoots of *Dendrocalamus hamiltoni.*
*Cyrtotrachelus longipes* Fabricius; India; bores in *Melocanna bambusioides.* (See plate IX.)

**Cossonidæ.**
*Conarthrus affinis* Wollaston; India; bores in bamboos of *Dendrocalamus strictus.*

## LITERATURE.

STEBBING, E. P. A Manual of Forest Zoology for India, 1908.
STEBBING, E. P. Indian Forest Insects, 1914.

## BANANA; PLANTAIN.

(*Musa* spp. (especially *paradisiaca*). Family Musaceæ.)

Bananas and plantain have become a very important article of commerce, being mainly imported from the West Indies and Central America. Since the plant can only be propagated from suckers or sprouts there is danger of introducing pests into the country in this manner. The banana is grown very extensively in the Southern States as a hedge plant. The compact nature of the fruit bunches makes it possible for many insects of considerable size to find entrance into the country in the bunches as well as in the fruit itself.

## A. BETTER KNOWN BANANA PESTS LIKELY TO BE IMPORTED.

### Cosmopolites sordidus Germar (Sphenophorus.)

(Banana Root Borer. Calandridæ; Coleoptera.)

*Hosts:* Banana (all varieties), sugar cane.

*Injury:* Serious pest to young banana plants in Fiji.

*Description and biology: Adult* 14 mm. in length,.4 mm. in breadth, color dark brown to black, head with prominent rostrum, antennæ elbowed. *Pupa* soft and white when newly formed. Pupal stage lasts from 6 to 8 days in the bulb. *Larva* 20 mm. in length, 8 mm. in breadth, cream colored, footless, and requires about 20 days to reach pupal stage. *Eggs* presumably deposited singly on base of stem near the crown. The larvæ, upon hatching, work their way inward and down toward the bulb.

*Distribution:* Fiji, British New Guinea. [In eastern hemisphere South Pacific Ocean to Indian Archipelago.] Jamaica, India, Brazil.

JEPSON, FRANK P. Dept. Agric. Fiji, Rept. Econ. Entom., Council Paper No. 25, 1911, p. 48, fig.

### Dacus curvipennis Froggatt.

(Banana Fruit Fly. Trypetidæ; Diptera.)

*Host:* Banana.

*Injury:* Breeds in fruit.

*Description: Adult* about 6 mm. long; head yellow; thorax with elongate bar of silvery white; legs yellow; tarsi and hind femora darker; abdomen elongate with base and two narrow transverse black bands below, sheath and ovipositor elongate. (See plate XXVIII, figs. *b*, *d*.)

*Distribution:* Fiji.

FROGGATT, W. W. Dept. Agric., New South Wales, Farmers' Bul. 24, 1909, p. 28.

## B. OTHER IMPORTANT BANANA INSECTS.

### HEMIPTERA.

**Aleyrodidæ.**

*Aleurodicus cocois* Curtis; West Indies, Mexico, Central and South America. (See Cocoanut.)

**Coccidæ.**

*Pseudococcus grassi* Leonardi; Italy.

### COLEOPTERA.

**Calandridæ.**

*Rhabdocnemis obscurus* Boisduval. (See Sugar cane.)

### LEPIDOPTERA.

**Pyralidæ.**

*Dichocrocis punctiferalis* Guénée; Queensland. (See Corn.)

**Castniidæ.**

*Castnia licus* Drury; South America. (See Sugar cane.)

**Tineidæ.**

*Ereunetis flavistriata* Walsingham; Hawaii. (See Sugar cane.)

### DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann. (See Fruit.)
*Rioxa musae* Froggatt; Australia. (See Fruit.)
*Bactrocera tryoni* Froggatt; Orient. (See Fruit.)

## BARLEY.

(*Hordeum vulgare.* Family Gramineæ.)

Barley is a grain with many varieties grown in various parts of the world, especially Europe and Asia. There is danger of importing pests of the grain only, unless the straw should be used for packing. Its pests are discussed under Grains and Grasses.

## BAY.

(*Laurus* spp. Family Lauraceæ.)

Evergreen plants much cultivated for their shrubbery.

### INSECTS ATTACKING BAY TREES.

#### HEMIPTERA.

**Coccidæ:**

- Armored—
  - **Aspidiotus britannicus* Newstead; Europe.
  - *Aspidiotus* (*Aonidia*) *lauri* Bouché; Germany, Australia, Greece, Italy, Spain, Portugal; *Laurus canariensis.*
  - *Aspidiotus* (*Chrysomphalus*) *paulistus* Hempel; Brazil.
  - *Aspidiotus* (*Chrysomphalus*) *scutiformis* Cockerell; Mexico, Central America.
  - *Cryptaspidiotus aonidioides* Lindinger; Canary Islands; *Laurus canariensis.*
  - *Parlatoria calianthina* Berlese & Leonardi; Italy.
- Unarmored—
  - *Coccus acuminatus* Signoret; Hawaii, Ceylon, France.
  - *Eucalymnatus brunfelsiæ* Hempel; Brazil; *Laurus camphora.*
  - *Icerya montserratensis* Riley & Howard; West Indies, Mexico; *Laurus camphora.*
  - *Paralecanium geometricum* Green; Ceylon, China; *Laurus canariensis.*
  - *Platinglisia noacki* Cockerell; Brazil.
  - *Pseudococcus indicus* Signoret; France; *Laurus indicus.*
  - *Pseudococcus laurinus* Boisduval; France; *Laurus nobilis.*
  - *Pulvinaria plana* Lindinger; Canary Islands; *Laurus canariensis.*

## BEAN.

(*Phaseolus vulgaris.* Family Leguminosæ.)

This species includes the kidney, common field, garden, snap, and string beans. It is probably of tropical American origin. The beans are an article of commerce and very likely to introduce pests.

### BROAD BEAN.

(*Vicia faba.* Family Leguminosæ.)

The broad bean is a native of Asia, but is grown extensively in Europe and North America, especially as a food for domestic animals and for human consumption. The beans are an article of commerce and quite likely to introduce pests.

### LIMA BEAN.

(*Phaseolus lunatus.* Family Leguminosæ.)

The lima or sugar beans are native to South America. They are articles of commerce and quite likely to introduce pests.

### A. BETTER KNOWN BEAN INSECTS LIKELY TO BE IMPORTED.

#### Mylabris (Bruchus) spp., etc.

(Bean and Pea Weevils. Mylabridæ [Bruchidæ]. Coleoptera.)

Many of the weevils attacking beans are cosmopolitan and have been introduced into the United States. The fact that they breed in perfectly dry stored beans makes their distribution very easy.

*Species: M. loti* Paykull; seed of *Lotus* and *Lathyrus*. *M. atomarius* Linnaeus; very common: *Vicia faba*, *Lathyrus*, *Vicia sepium*, etc. * *M. rufimanus* Boheman; Europe, North Africa, Egypt, Persia, Syria, introduced into California; beans, peas. An important pest. *M. affinis* Frölichs: France, imported into Ireland and East Indies: beans. * *M. piscrum* Linnæus; distributed from Orient until now cosmopolitan; a very serious pest; peas. *Vicia*, *Cytisus laburnum*. (See text fig. 20.) *M. lentis* Frölichs; Europe, Egypt, Syria, lentils. *M. pallidicornis* Boheman; lentils. * *Acanthoscelides obtectus* Say; now cosmopolitan; peas, cowpeas, lentils, beans. (See text fig. 21.) * *Pachymerus chinensis* Linnæus; now almost cosmopolitan; cowpeas, *Phaseolus radiatus*, *Cajanus indicus*, peas, lentils, beans, *Dolichos*, sorghum. (See text fig. 22.) * *P. quadrimaculatus* Fabricius; now almost cosmopolitan; cowpeas, peas, beans. (See text fig. 23.)

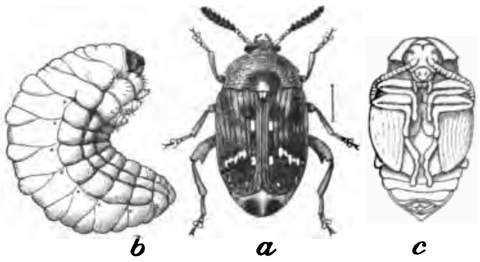


FIG. 20.—The pea weevil (*Mylabris pisorum*): *a*, Beetle; *b*, larva; *c*, pupa. Enlarged. (Chittenden.)

*Description:* These weevils are small, somewhat flattened, rounded or oblong, with head concealed beneath. The larvæ breed in the seed of beans and peas and pupate there.

SORAUER, P.: Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 535–537.
CHITTENDEN, F. H.: U. S. Dept. Agric., Yearbook 1898, pp. 233-260.

### **Spermophagus pectoralis** Sharp.

(Mexican bean weevil. Mylabridæ; Coleoptera.)

*Host:* Beans.

*Injury:* To dried beans, which it destroys for successive generations like the common bean weevil.

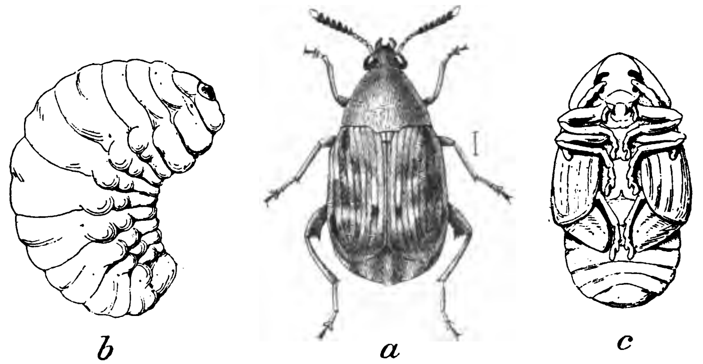


FIG. 21.—Bean weevil (*Acanthoscelides obtectus*): *a*, Adult; *b*, larva; *c*, pupa. (Chittenden.)

*Description:* A small black rounded beetle with white marks on the elytra or wing-covers.

*Distribution:* Mexico, Guatemala, Nicaragua, Panama, Brazil, Texas.

CHITTENDEN, F. H.: U. S., Dept. Agric., Yearbook 1898, pp. 233-260.

### Agromyza phaseoli.

(Bean Fly. Agromyzidae; Diptera.)

*Hosts:* Lima, Tonga, French, and Madagascar beans.
*Injury:* Larvae bore in stalks.
*Distribution:* Australia.

FROGGATT, W. W. Agricultural Gazette, N. S. W. Feb., 1911.
JARVIS, E. Queensland Agricultural Journal, March, 1913, pp. 192–195, Plates 30, 31.

### Lycæna bætica.

(Blue or Hairstreak Butterfly. Lycaenidæ; Lepidoptera.)

*Hosts:* Beans, garden peas, cowpeas, Jack beans, crotalarias, and pigeon peas.
*Injury:* Larvæ attack pods, devouring growing seeds.
*Distribution:* Hawaii.

FULLAWAY, D. T. Annual Report, Hawaii Agri. Exp. Sta. 1911 (1912), p. 21.

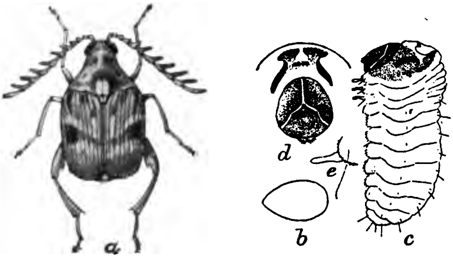


FIG. 22.—Bean weevil (*Pachymerus chinensis*): *a*, Adult; *b*, egg; *c–e*, larva and details. (Chittenden.)

### Hyalopeplus pellucidus.

(Hawaiian leaf-bug. Capsidae; Heteroptera.)

*Host:* Pigeon peas.
*Injury:* By sucking juices from plants.
*Distribution:* Hawaii.

FULLAWAY, D. T. Annual Report, Hawaii Agri. Exp. Sta. 1911 (1912), p. 23.

### Zizera labradus Godt.

(Victoria Bean Butterfly. Lycaenidæ; Lepidoptera.)

*Hosts:* Beans, peas.
*Injury:* Feeds in the pods, a serious pest in Victoria.
*Description:* Butterfly one of the group known as "Blues." Larva flattened, green, very hairy. Egg circular, pitted.

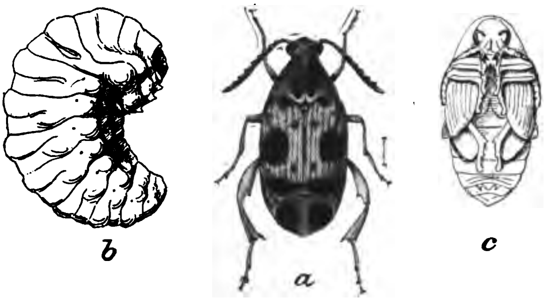


FIG. 23.—Bean weevil (*Pachymerus quadrimaculatus*): *a*, Adult; *b*, larva; *c*, pupa. (Chittenden.)

*Distribution:* Australia.

FRENCH, C.: Handbook of Destructive Insects of Victoria, pt. 4, 1909, pp. 62–66, pl. 49.

### Maruca testulalis Geyer.

(Bean Pod Borer. Pyralidæ: Lepidoptera.)

*Hosts:* Mung (*Phaseolus mungo*), moth (*Phaseolus aconitifolius*), tur (*Cajanus indicus*).
*Injury:* Breeds in the pods of legumes.
*Description and biology: Adult* wing expanse 26–30 mm., fuscous brown, forewing with conspicuous black edged white spot, hind wing white, with a marginal fuscous band. *Larva* 12 mm. long, green; sometimes with a pink tinge, hairs on small black tubercles. Bores inside of the pods and pupates in its borings.
*Distribution:* Australia and Asia.

MAXWELL-LEFROY, H. M. Mem. Dept. Agric. India, vol. 1, 1907, p. 216, fig. 66.

### B. OTHER IMPORTANT BEAN INSECTS.

COLEOPTERA.

**Chrysomelidæ.**

*Cerotoma denticornis* Olivier, leaf beetle; Porto Rico (see text fig. 24).

**Curculionidæ:**

*Sitona lineata* Linnæus,* *S. flavescens* Marsh.; Europe. (See Clover.)
*Hypera variabilis* Herbst; Europe. (See Clover.)

DIPTERA.

**Trypetidæ.**

*Dacus cucurbitae* Coquillett; India, Ceylon, Hawaii; attacks fruit. (See Cucurbits).
*Ceratitis capitata* Wiedemann, attacks *Phaseolus vulgaris*. (See Fruit.)
*Bactrocera cucurbitæ.*
*Bactrocera tryoni.*

**Anthomyiidæ.**

* *Chortophila (Pegomya) fusciceps* Zetterstedt. (See Corn.)

**Agromyzidæ.**

*Agromyza fabalis* Jack; bean stem maggot, Rhodesia, mines stems of cowpeas, French beans, kidney and haricot beans.

LEPIDOPTERA.

**Hesperidæ.**

* *Eudamus proteus* Linnæus, bean leaf roller; Porto Rico; Southern States.

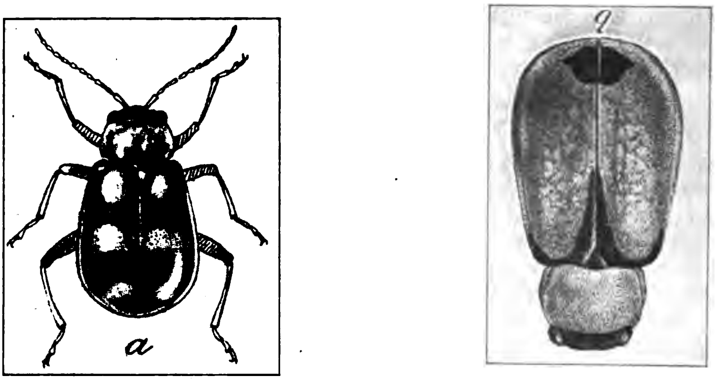


FIG. 24.—Bean leaf-beetle (*Cerotoma denticornis*): Adults, two varieties. (Chittenden.)

## BEECH.

(*Fagus* spp. Family Fagaceæ.)

This genus contains tall, hardy, deciduous trees favored for parks. The wood is valuable and the nuts edible. The nuts also yield an oil used for cooking. Propagated from seed. Valuable for nursery stock.

### A. BEECH PESTS LIKELY TO BE IMPORTED.

#### **Laspeyresia grossana** Haworth. (**Carpocapsa.**)

(Beech Tortrix. Tortricidæ; Lepidoptera.)

*Hosts:* Hazelnut, walnut, oak, beech, chestnut.

*Injury:* Seldom serious. Attacks fruits of its hosts.

*Description and biology: Adult,* forewing bluish ash-gray; translucent spot brownish gold streaked with black, brown at base, bounded by triangular spots. Flies in June and July (Germany). *Pupates* in spring in the earth. *Larva* attacks nuts in late summer, winters in earth.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 276.

## B. OTHER IMPORTANT BEECH PESTS.

### HEMIPTERA.

**Aphididæ.**

*Pterochlorus exsiccator* Altum, a nonmigratory plant louse; middle Europe; very injurious to the twigs and stems of young trees.

**Phyllaphis fagi* Linnæus, nonmigratory plant louse; Europe; feeds on foliage.

**Coccidæ:**

Unarmored—

*Cœlostomidia assimilis* Maskell; New Zealand; attacks *Fagus menziesii* and *F. fusca.*

*Cœlostomidia pilosa* Maskell; New Zealand.

*Cryptococcus fagi* Baerensprung; Europe; *Fagus sylvatica.*

*Eriococcus aceris* Signoret; Europe; *Fagus silvatica.*

*Eriococcus fagicorticus* Maskell; New Zealand; *Fagus fusca.*

*Eriococcus pallidus* Maskell; New Zealand; *Fagus fusca.*

*Eriococcus raithbyi* Maskell; New Zealand; *Fagus menziesii.*

*Gossyparia cavellii* Maskell; New Zealand; *Fagus menziesii.*

*Inglisia fagi* Maskell; New Zealand.

*Phenacoleachia zealandica* Maskell; New Zealand.

*Pulvinaria betulæ* Linnæus; Europe; *Fagus sylvatica.*

*Rhizococcus intermedius* Maskell; New Zealand; *Fagus menziesii.*

*Rhizococcus pulchellus* Maskell; New Zealand; *Fagus fusca, F. menziesii, F. cliffortioides.*

*Rhizococcus totaræ* Maskell; New Zealand; *Fagus menziesii.*

*Ripersia fagi* Maskell; New Zealand; *Fagus menziesii.*

*Solenococcus fagi* Maskell; New Zealand.

### COLEOPTERA.

**Anobiidæ.**

*Xestobium plumbeum* Illiger; Europe; injures wood for technical purposes.

*Xestobium rufovillosum* De Geer; Europe; injures wood for technical purposes.

*Ptilinus pectinicornis* Linnæus; Europe; bores in wood.

**Elateridæ.**

*Athous subfuscus* Müller, a snapping beetle; Europe; larvæ destroy germinating beech.

**Lymexylonidæ.**

*Hylecœtus dermestoides* Linnæus; Europe; breeds in bark and wood.

**Scarabæidæ.**

*Amphimallon solstitialis* Linnæus; Europe; develops like the June beetle at the roots of trees.

*Melolontha hippocastani* Fabricius, and *M. melolontha* Linnæus; Europe; also breed at the roots of seedlings and as adults feed on the foliage.

*Polyphylla fullo* Linnæus; Europe; breeds at the roots of trees and the adults feed on the foliage.

**Buprestidæ.**

*Agrilus angustulus* Illiger, *A. biguttatus* Fabricius, *A. elongatus* Herbst, and **A. viridis* Linnæus (see Oak); wood borers; Europe; attack bast and sapwood, especially of young trees.

**Cerambycidæ.**

*Callidium æneum* DeGeer; and *C. violaceum* Linnæus; long-horned wood borers; Germany; attack wood of felled trees and lumber.

*Saperda scalaris* Linnæus; Europe; bores in wood. (See Poplar.)

**Chrysomelidæ.**

*Haltica quercetorum* Foudr.; a leaf beetle; Germany. (See Oak.)

**Brachyrhinidæ.**

*Strophosoma capitata* De Geer, and *S. melanogramma* Forster, weevils; Europe; adults feed on the leaves and buds of seedlings.

*Polydrusus cervinus* Linnæus, *P. chrysomela* Olivier, *P. griseomaculatus* Desbrochers, *P. lateralis* Gyllenhal, *P. micans* Schönherr, *P. mollis* Stroem, *P. picus* Fabricius,* *P. sericeus* Schall., and * *P. viridicollis* Baudi, weevils; Europe; as adults feed on buds and foliage; probably breed at the roots. The two latter species have been introduced into the United States.

*Phyllobius argentatus* Linnæus, *P. urticæ* De Geer and *P. viridicollis* Fabricius; weevils; Europe; adults injure buds and leaves.

**Attelabidæ.**

*Apoderus coryli* Linnæus, a leaf rolling weevil, Europe; larva breeds in the leaf rolls.

*Rhynchites alni* Müller and *Rhynchites betulae* Linnæus, leaf rolling weevils; Europe; larvæ breed in the leaf rolls.

*Byctiscus betulæ* Linnæus, a leaf rolling weevil; Europe.

**Curculionidæ.**
*Orchestes fagi* Linnæus, a small jumping weevil; Europe; mines the leaves.
*Hylobius abietis* Linnæus, a large weevil; Europe; bores in the bark of seedlings.

**Cossonidæ.**
*Rhyncolus lignyarius* Marsh., a small elongate weevil; Europe; bores in the trunks.
*Rhyncolus truncorum* Germar, a small weevil; Europe; bores in timber.

**Scolytidæ, Ipidæ.**
*Scolytus intricatus* Ratzeburg; Russia, Germany; makes galleries in bast.
*Anisandrus dispar* Fabricius; Germany; makes galleries in wood, causing great damage.
*Ernoporus fagi* Fabricius; Europe; makes galleries in bark of *Fagus sylvatica*.
*Taphrorychus bicolor* Herbst, and *T. villifrons* Dufour; Europe; make galleries in bark.
*Xyleborus dryographus* Ratzeburg, and *X. monographus* Fabricius; Europe; makes galleries in the wood of living trees.
*Xyloterus domesticus* Linnæus, and *X. signatus* Fabricius; Europe; makes galleries in sapwood of branches and in the wood of the trees.

## LEPIDOPTERA.

**Cossidæ.**
∗*Zeuzera pyrina* Linnæus; Europe, Africa, North America; breeds in the wood. (See Horse-chestnut.)
*Cossus cossus* Linnæus; the goat moth; Europe; breeds in the wood. (See Willow.)

**Drepanidæ.**
*Drepana cultraria* Fabricius; Europe; defoliator.

**Notodontidæ.**
*Phalera bucephala* Linnæus; Europe. (See Forests.)

**Geometridæ.**
*Cheimatobia boreata* Hübner; Germany; feeds on young growth.
*Hibernia aurantiaria* Esp., *H. defoliaria* Linnæus and *H. marginaria* Borckh.; Europe; feed on foliage.
*Larentia dilutata* Borckh.; Europe; feeds on foliage.

**Lasiocampidæ.**
*Malacosoma neustria* Linnæus; Europe; feeds on buds and leaves (see Forests).

**Lymantriidæ.**
*Dasychira pudibunda* Linnæus, ∗*Euproctis chrysorrhœa* Linnæus, ∗*Lymantria monacha* Linnæus, ∗*Porthetria dispar* Linnæus, *Porthesia similis* Fuessly (see Forests).

**Noctuidæ.**
*Acronycta aceris* Linnæus; Europe; defoliator.
*Scopelosoma satellitia* Linnæus; Germany; injurious to young growth.

**Plutellidæ.**
*Cerostoma parenthesella* Linnæus; Europe; attacks leaves of seedlings.

**Tortricidæ.**
∗*Peronea ferrugana* Treitschke; Europe; North America; attacks leaves.
*Tortrix podana* Sc.; Europe; attacks leaves of seedlings.

## HYMENOPTERA.

**Cimbicidæ.**
*Cimbex fagi* Zadd.; sawfly; Europe; feeds on foliage.

**Xiphydridæ.**
*Xiphydrya camelus* Linnæus; wood wasp; Europe; bores in wood.

## DIPTERA.

**Itonididæ.**
*Hormomyia annulipes* Htg. and *H. fagi* Htg., gall midges, Europe; from galls on leaves.

## LITERATURE.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
Lindinger, L. Die Schildläuse (Coccidæ), 1912.
Bargagli, P. Rassegna Biologica Rincofori Europei, 1883–1887.
Fernald, Maria E. Catalogue of Coccidæ of the World, Mass. Agr. Coll., Bul. 88, 1903.

## BEET; MANGELWURZEL OR MANGOLD; SUGAR BEET; CHARD.

(*Beta vulgaris* Linnæus. Family Chenopodiaceæ.)

The beet and its varieties are grown from seed. The varieties have been developed either for their roots or their foliage, which are edible. A race of showy foliage beets has been developed which make excellent flower-garden borders. The species occurs in America, Europe, and as far east as Persia, and the Caspian Sea. Insects are most likely to be introduced in shipments of beet roots.

### A. BETTER KNOWN BEET INSECTS LIKELY TO BE IMPORTED.

**Atomaria linearis** Stephens.

(Pigmy Mangold Beetle. Cryptophagidæ; Coleoptera.)

*Hosts:* Mangolds, beets, sugar beets.

*Injury:* Very destructive by destroying sprouts at time of germination and later attacking both roots and leaves.

*Description: Beetle* 1–1.5 mm. long, dark brown, with fine pubescence. The life history has not been worked out.

*Distribution:* Europe (England).

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 475, fig. 290.

THEOBALD, FRED. V. First Rept. Econ. Zool., Brit. Mus. Nat. Hist., 1903, pp. 8, 9, figs.

JABLONOWSKI, JOZSEF. Die Tierischen Feinde der Zuckerrübe (translation by Julius Reitzer), 1909, pp. 136–142, fig. 31.

* **Cassida nebulosa** Linnæus.

(Beet Tortoise Beetle. Cassididæ; Coleoptera.)

*Host:* Beets, sugar beet, orache, lambsquarter, *Atriplex*, etc.

*Injury:* Both larva and adult feed on the foliage.

*Description:* Beetle dorsally flattened in the shape of a tortoise shell, about 6 mm. long, yellowish gray or pale green.

*Distribution:* Europe, Asia (Persia to Siberia), and recorded from California in 1894.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3. p. 533.

CHITTENDEN, F. H. U. S. Dept. Agr., Div. Entom., 1903, bul. 43, p. 14, fig. 6.

JABLONOWSKI, JOZSEF. Die Tierschen Feinde der Zuckerrübe translation by Julius Reitzer), 1909, pp. 261–263, fig. 55.

**Cleonus punctiventris** Germar.

(Beet Root Weevil. Curculionidæ; Coleoptera.)

*Hosts:* Beet, *Polygonum*, thistle, goosefoot, tobacco, *Salsola.*

*Injury:* Adults feed on young plants; larvæ feed at the roots of beets. Very destructive in east Europe.

*Description and biology:* An elongate subcylindrical weevil with stout beak. The larvæ feed at roots as low as 60 cm. below the surface. Pupate in the larval feeding places.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 546, 547.

**Gelechia ocellatella** Boyd; **Gelechia atriplicella** F. R.; **Gelechia instabilella** Douglas. **(Lita.)**

(Beet leaf miners. Gelechiidæ; Lepidoptera.)

*Hosts:* Beets, sugar beets, mangolds.

*Injury:* Mine the leaves, and sometimes *G. ocellatella* bores in the crown and a short distance into the roots.

*Description and biology: G. ocellatella* is a small yellowish gray moth with dark ribs and an apical spot on the front wings; hind wings as large as front and whitish gray; pupates in leaf rolls, in the roots or outside. Larva 10 to 12 mm. long, pale greenish with a transverse row of reddish spots on each segment and two or three longitudinal rose colored stripes. Feeds on leaves and for a short distance into the roots.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 263, f. 192.

JABLONOWSKI, JOZSEF. Die Tierischen Feinde der Zuckerrübe (translation by Julius Reitzer), 1909, pp. 136–142.

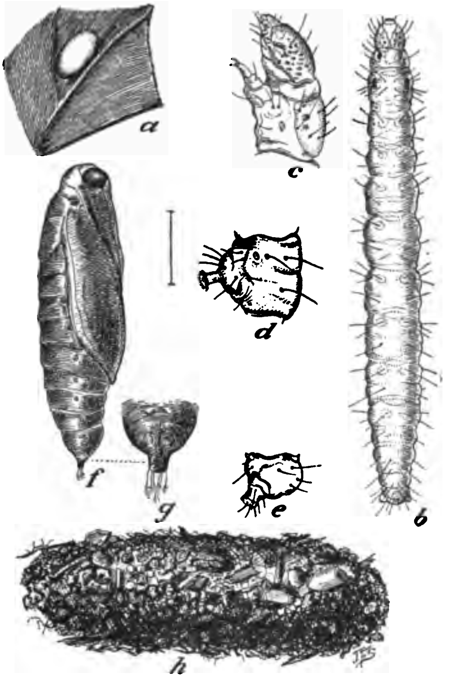


FIG. 25.—Hawaiian beet webworm (*Hymenia fascialis*): *a*, Egg on leaf; *b*, larva, dorsal view; *c*, larva, head and first thoracic segment; *d*, abdominal segment, lateral view; *e*, anal segment; *f*, pupa, lateral view; *g*, cremaster; *h*, cocoon. All enlarged. (Marsh.)

∗ **Hymenia fascialis** Cramer.

(Hawaiian Beet Webworm. Pyralidæ; Lepidoptera.)

*Hosts:* Sugar beet, Swiss chard, mangel-wurzel, *Amarantus*, *Euxolus*, purslane (*Portulaca oleracea*), cucumber, Chenopodiaceae.

*Injury:* Capable of doing considerable damage to truck by feeding on foliage. Has been widely distributed. (See text figs. 25, 26.)

*Distribution:* Japan, Hawaii, Tropical America, Porto Rico, Europe, South Africa, Australia, Madagascar, Reunion, Mauritius, Florida, Alabama, California, District of Columbia.

MARSH, H. O. U. S. Dept. Agr., Bur. Entom., Bul. 109, pt. 1, 1911, pp. 1–15, pl. 1, figs. 1, 2.

∗**Chortophila** (**Pegomya**) **hyoscyami** Panzer. (**Phorbia vicina** Lintn.)

(Beet fly or spinach leafminer. Anthomyidæ; Diptera.)

*Hosts:* Spinach, beets, sugar beets, mangolds, orache, henbane, goosefoot.

*Injury:* Mines leaves. The mines are blisterlike.

*Description and biology. Fly* thorax lead gray, with five faint dorsal stripes, abdomen yellow gray with a faint brownish stripe; entire body with black bristles; head silver white, with reddish shimmer; front and scutellum with orange, silver gray streaks; eyes red; palpi yellow with dark apex; femora yellowish, tibiæ brown; length, 6 mm. The species varies in color and has received a number of names.

*Distribution:* Europe. Introduced into the United States and quite injurious to spinach.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 428, 429, fig. 261.

CHITTENDEN, F. H. U. S. Dept. Agr. Div. Ent., bul. 43, 1903, pp. 50–52, fig. 50 (*P. vicina* Lintner).

ORMEROD, Miss E. Manual Injurious Insects, 1890, pt. 1, pp. 144–147, fig. (*P. betae* Curt.).

JABLONOWSKI, JOZSEF. Die Tierischen Feinde der Zuckerrübe (translation by Julius Reitzer), 1909, pp. 303–315, figs. 61–63.

## B. OTHER IMPORTANT BEET INSECTS.

### ACARINA.

**Tetranychidæ.**

*Tetranychus telarius* Linnæus, the red spider; Europe; very injurious to sugar-beet foliage.

### HEMIPTERA.

**Aphididæ.**

*Aphis rumicis* Linnæus; Europe; sugar-beet foliage.

### ORTHOPTERA.

**Gryllotalpidæ.**

**Gryllotalpa gryllotalpa* Linnæus (*vulgaris* Latreille); Europe, introduced into New Jersey; injures roots.

**Gryllidæ.**

*Gryllus melas* Charp.; Europe; seriously injures the roots.

### COLEOPTERA.

**Silphidæ.**

**Blitophaga opaca* Linnæus; Europe, North America; feeds as larva on foliage of beets, an unusua habit for this family. It is harmless in America at present.

*Blitophaga undata* Miller; *Silpha obscura* Linnæus; and *Phosphuga atrata* Linnæus; Europe; larvae feed on foliage of beets.

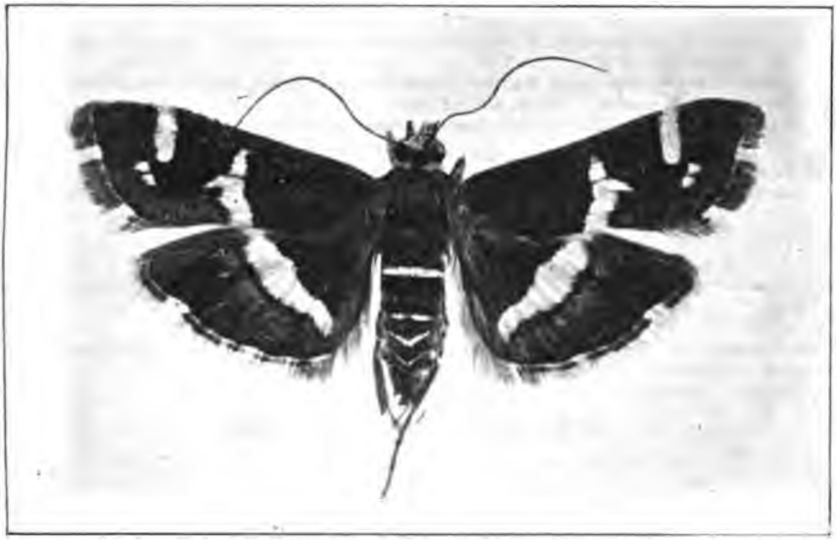


FIG. 26.—The Hawaiian beet webworm (*Hymenia fascialis*): Female moth. Enlarged. (Marsh.)

**Tenebrionidæ.**

*Pedinus femoralis* Linnæus, and *Gonocephalum* (*Opatrum*) *sabulosum* Linnæus; Hungary; larvæ injurious to roots of sugar beet; adults injure the foliage.

**Coccinellidæ.**

*Subcoccinella 24-punctata* Linnæus; Europe; larvae and adults injure vegetation.

**Elateridæ.**

*Lacon murinus* Linnæus and *Corymbites aeneus* Linnæus, wireworms; Europe; attack the roots of seedlings.

*Athous niger* Linnæus. (See Tobacco.)

*Agriotes lineatus* Linnæus. (See Tobacco.)

**Meloidæ.**

*Epicauta rufidorsum* Goeze, blister beetle; Europe; defoliates and sometimes destroys entire plants.

**Scarabæidæ.**

*Melolontha vulgaris* Linnæus, June beetle, Europe; larvæ feed at roots.

*Rhizotrogus æquinoctialis* Herbst; Europe; the larvæ feed at the crown and roots killing many plants.

**Chrysomelidæ.**

*Cassida vittata* Vill; Europe; larva and adult feed on foliage.

*Chalcoides chloris* Foudr., *Chætocnema tibialis* Illiger, *Psylliodes attenuata* Koch, *P. chrysocephala* Linnæus, *Phyllotreta vittula* Redtenbacher, *P. nemorum* Linnæus, *P. nigripes* Fabricius, *P. atra* Fabricius, *P. cruciferæ* Goeze, flea beetles; Europe; injure the foliage.

**Brachyrhinidæ (Otiorhynchidæ).**

*Brachyrhinus raucus* Fabricius (*Otiorhynchus*), *B. ligustici* Linnæus, *B. orbicularis* Herbst; Europe; adults injure the foliage and young plants.

*Psallidium maxillosum* Fabricius; Europe; adult injures plants.

**Curculionidæ.**

*Liparus coronatus* Goeze; Europe; breeds in the roots.

*Bothynoderes punctiventris* Germar; and *B. farinosus* Fahraeus; Europe; adults injure foliage, larvæ breed in roots.

*Cleonus piger* Scopoli, *C. fasciatus* Müller, *C. mendicus* Gyllenhal, *C. tigrinus* Panzer, *C. ucrainiensis* Gawr., *C. pedestris* Podg., *C. cinereus* Schr.; Europe; breed in roots of beets or adults attack seedlings and foliage.

*Lixus ascanii* Linnæus; Europe; breeds in the stems.

*Cionus scrophulariæ* Linnæus; Europe; adults feed on foliage of beets and mangolds.

### LEPIDOPTERA.

**Pyralidæ.**

**Phlyctænia ferrugalis* Hübner; Europe, Asia, North America (see Cabbage).

**Noctuidæ.**

*Agrotis segetum* Schiffermiller, *A. plecta* Linnæus, *A. exclamationis* Linnæus, cutworms; Europe; injure young plants and roots.

*Mamestra brassicæ* Linnæus, *M. dissimilis* Kn., *M. oleracea* Linnæus; Europe; feed on foliage.

*Calocampa exoleta* Linnæus; Europe; attacks beets.

**Plusia gamma* Linnæus; Europe; Asia, North America; in Europe injurious to beets.

### HYMENOPTERA.

**Tenthredinidæ.**

*Athalia spinarum* Fabricius, a saw fly; Europe; South Africa; attacks foliage of beets (see Turnip).

### DIPTERA.

**Tipulidæ.**

*Pachyrhina maculata* Meigen, a crane fly; Europe; larva attacks the roots of beets.

*Tipula oleracea* Linnæus and *Tipula paludosa* Meigen; Europe; also occasionally attack beet roots.

### LITERATURE.

Jablonowski, J. Die Tierischen Feinde der Zuckerrübe (translation by J. Reitzer), Budapest, 1909.
Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d edit., 1913, vol. 3.
Bargagli, P. Rassegna Biologica di Rincofori Europei, 1883–1887.

## BERSEEM; EGYPTIAN CLOVER.

(*Trifolium alexandrinum* Linnæus. Family Leguminosæ.)

This forage plant has been introduced in a small measure into the United States from Egypt. It has a number of important enemies in Egypt which attack other crops also grown in this country. (See Clover.)

## BETEL NUT.

(*Areca catechu*, etc. Family, Palmaceæ.)

A tropical palm yielding the betel nut of commerce.

### IMPORTANT ARECA INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—

*Aspidiotus* (*Chrysomphalus*) *alienus* Newstead; *Areca lutescens*.

**Pinnaspis buxi* Bouché; Trinidad, Brazil, New York, District of Columbia; *Areca catechu*, *A. lutescens*. Female scale 1—1.5 mm. long, narrow, reddish-brown or orange-brown with extremity lighter. Second exuvium comparatively large, occupying a trifle over one-third the puparium, which bears a strong resemblance to that of *Lepidosaphes*. Sides nearly parallel.

Unarmored—

*Coccus acutissimus* Green; Ceylon; *Areca catechu*. (See Mango.)

*Coccus minimus* Newstead; England; Mexico; *Areca catechu*.

*Leucodiaspis cockerelli* de Charmoy; Brazil; *Areca lutescens*.

## BIRCH.

(*Betula* spp. Family Betulaceæ.)

Ornamental deciduous trees or shrubs grown chiefly for their bright green handsome foliage. There are many species occurring in North America, Europe, north and central Asia. Propagated from seed and readily transplanted. The bark and wood are of value in the arts and crafts, and some species yield a sap used as a beverage. The bark of *B. papyrifera* is used in making canoes and for tanning leather.

### A. BETTER KNOWN BIRCH PESTS LIKELY TO BE IMPORTED.

#### **Eriophyes rudis** Can.

(Birch Blister Mite. Eriophyidæ; Acarina.)

*Hosts: Betula alba, B. pubescens, B. odorata.*

*Injury:* Causes gall-like swellings of the buds. Ultimately kills a tree.

*Description and biology:* A four-legged blister mite which forms gall-like swellings of the buds. Very easy to introduce on nursery stock.

*Distribution:* Europe, England (especially severe around London).

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d edit. vol. 3, 1913, p. 117, 118. fig. 93.

#### **Magdalis carbonaria** Linnæus.

(Birch Twig Weevil. Curculionidæ; Coleoptera.)

*Hosts: Corylus avellana* L., *Prunus domestica* L., *Betula alba* L., *Juglans regia* L., *Pinus.*

*Injury:* Breeds in young twigs.

*Description and biology:* Weevil similar to the common Magdalis species of this country. The eggs are laid in small dead or injured twigs. Larva feeds in medullary canal of twigs. Pupates in tunnel. Adults feed on foliage.

*Distribution:* Europe.

Bargagli, P. Rassegna Biologica Rincofori Europei, 1883-1887, p. 194.

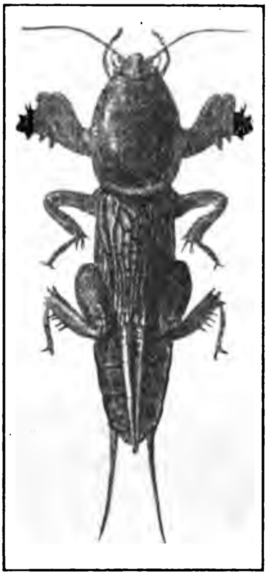


Fig. 27.—Mole cricket, *Gryllotalpa.* (Kurdjumov.)

### B. OTHER IMPORTANT BIRCH PESTS.

#### HEMIPTERA.

**Aphididæ.**

*Glyphina betulæ* Kaltenbach, a plant louse; Germany; attacks leaves and twigs.

**Coccidæ:**

Armored—

*Chionaspis salicis* Linnæus; Europe.

Unarmored—

*Lecanium ciliatum* Douglas; Europe.

*Lecanium coryli* Linnæus; Europe.

*Lecanium pulchrum* Marchal; Europe; *Betula verrucosa.*

*Pulvinaria betulæ* Linnæus; Europe; *Betula alba.*

#### ORTHOPTERA.

**Gryllotalpidæ.**

**Gryllotalpa gryllotalpa* Linnæus; Europe, New Jersey; injures roots, young shoots, and germinating seed. (See text, fig. 27.)

## COLEOPTERA.

**Buprestidæ.**

**Agrilus viridis* Linnæus; a wood borer; Europe; bores in bast and sapwood of seedlings and young stems and branches of older trees.

**Lymexylonidæ.**

*Hylecœtus dermestoides* Linnæus; a wood borer; Germany, Sweden.

**Passalidæ.**

*Basilianus cantori* Perch.; a large black beetle; India; breeds in rotting wood.

**Scarabæidæ.**

*Anomala ænea* De Geer, Europe, adults attack foliage.

*Melolontha hippocastani* Fabricius, and *M. melolontha* Linnæus, June beetles; breed at the roots of seedlings, and adults feed on foliage.

*Polyphylla fullo* Linnæus; Europe; also attacks roots and foliage in the same manner.

**Chrysomelidæ.**

*Agelastica alni* Linnæus; a leaf beetle; Europe; larvæ and adults feed on foliage.

*Lochmæa capreæ* Linnæus; Europe; larvæ and adults feed on foliage.

*Melasoma ænea* Linnæus; Europe; larvæ and adults feed on foliage.

*Haltica quercetorum* Foudr.; Europe; defoliates. (See Oak.)

**Cerambycidæ.**

*Rhagium mordax* De Geer; Sweden; bores in stems and branches.

**Attelabidæ.**

*Rhynchites betulæ* Linnæus, *Apoderus coryli* Linnæus, and *Byctiscus betulæ* Linnæus; leaf-rolling weevils; Europe; the larvæ breed in the rolls.

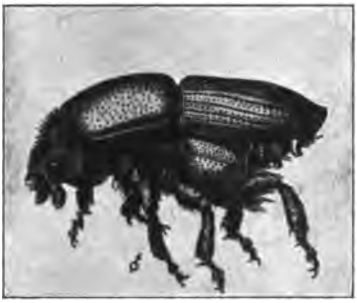


FIG. 28.—*Scolytus ratzeburgi:* Male much enlarged. (Nüsslin.)

**Brachyrhinidæ (Otiorhynchidæ).**

*Strophosoma capitata* De Geer, and *S. melanogramma* Forster; weevils; Europe; adults feed on foliage, and larvæ at the roots.

*Brachyderes incanus* Linnæus, a weevil; Europe; adults feed on foliage.

*Metallites iris* Olivier; Europe; breeds at roots, adults attack buds and leaves.

*Polydrusus cervinus* Linnæus, *P. intermedius* Zetterstedt, *P. planifrons* Gyllenhal, and *P. undatus* Fabricius; Europe; feed as adults on foliage of *Betula alba*, and probably some of them breed on the plant. This is a dangerous genus.

*Phyllobius argentatus* Linnæus, *P. betulæ* Fabricius, *P. maculicornis* Germar, *P. pyri* Linnæus, and *P. sinuatus* Fabricius; Europe; feed as adults on foliage and probably some of them breed on the plant.

**Curculionidæ.**

*Anoplus plantaris* Schönherr; Europe; adults feed on buds and young leaves.

*Hylobius abietis* Linnæus; Europe; bores in the bark.

**Cryptorhynchus lapathi* Linnæus; Europe; breeds in young shoots, branches, bark, and wood. An important pest introduced into the United States.

**Scolytidæ, Ipidae.**

*Scolytus ratzeburgi* Janson, and *S. rugulosus* Ratzeburg; Europe; make galleries in bark. (See text fig. 28.)

*Anisandrus dispar* Fabricius; Germany; makes galleries in wood.

*Xyloterus domesticus* Linnæus, and *X. signatus* Fabricius; Germany; galleries in sapwood.

## LEPIDOPTERA.

**Cossidæ.**

*Cossus cossus* Linnæus; goat moth; Europe; bores in wood. (See Willow.)

**Zeuzera pyrina* Linnæus; Europe, Africa, North America; bores in wood. (See Horse chestnut.)

**Geometridæ.**

*Anisopteryx æscularia* Schiffermiller; a looper; Europe; feeds on foliage.

*Cheimatobia boreata* Hübner; Europe; feeds on buds, leaves, and new growth.

*Hibernia aurantiaria* Esp., *H. defoliaria* Linnæus, and *H. marginaria* Borckh.; Germany; feed on buds and leaves.

*Larentia dilutata* Borckh.; Europe; feeds on foliage of *Betula odorata.*

*Larentia nebulata* Tnbg.; Sweden; feeds on foliage.

**Lasiocampidæ.**

*Eriogaster lanestris* Linnæus; Germany; feeds on foliage.

*Malacosoma neustria* Linnæus; Europe; defoliator. (See Forests.)

**Lymantriidæ.**
*Dasychira pudibunda* Linnæus, ⁎*Lymantria monacha* Linnæus, ⁎*Porthetria dispar* Linnæus, *Porthesia similis* Fuessly, forest defoliators; Europe. (See Forests.)

**Sesiidæ.**
*Sesia spheciformis* Grng.; Europe; bores in trunk.
*Sesia scoliæformis* Borckh.; Sweden; bores in trunk.

**Tortricidæ.**
⁎*Peronea ferrugana* Treitschke; Europe, North America; attacks foliage.

**Notodontidæ.**
*Phalera bucephala* Linnæus; Europe. (See Forests.)

### HYMENOPTERA.

**Cimbicidæ.**
*Cimbex variabilis* Klg., a saw fly; Europe; feeds on foliage.
*Trichiosoma lucorum* Linnæus; Europe; defoliates.

**Tenthredinidæ.**
*Nematus* (*Croesus*) *septentrionalis* Linnæus; Europe; defoliates.
*Priophorus padi* Linnæus; Europe (see Plum).

**Xiphydridæ.**
*Xiphydrya prolongata* Linnæus, wood wasp; Europe; bores in the wood.

### BIBLIOGRAPHY.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3rd edit., 1913, vol. 3.
Nüsslin, O. Leitfaden der Forstinsektenkunde, 2nd edit., 1913.
Bargagli, P. Rassegna Biologica Rincofori Europei, 1883–1887.
Trägårdh, I. Sveriges Skogsinsekter, 1914.
Lindinger, L. Die Schildläuse (Coccidæ), 1912.

## BLACKBERRY; RASPBERRY; LOGANBERRY.

(*Rubus* spp. Family Rosaceæ.)

A large genus of shrubs bearing many different kinds of delicious small fruit natives of America, Europe, and Asia.

### IMPORTANT BLACKBERRY INSECTS.

### COLEOPTERA.

**Byturidæ.**
*Byturus tomentosus* Fabricius; Europe; larva feeds in fruit of raspberries and blackberries.

**Brachyrhinidæ.**
*Brachyrhinus tenebricosus* Herbst; Europe; larvæ attack roots, adults attack foliage.

**Curculionidæ.**
*Rhinaria perdix* Pascoe; Australia.
*Hypera variabilis* Herbst; Europe; raspberry. (See Clover.)
*Anthonomus rubi* Herbst; Europe; larva at roots, adult attacks foliage.

### LEPIDOPTERA.

**Tortricidæ.**
*Notocelia roborana* Treitschke; Europe. (See Currant.)

**Sesiidæ.**
*Bembecia hylæiformis* Lasp.; Europe; bores canes.

**Lasiocampidæ.**
*Macrothylacia rubi* Linnæus; Europe; defoliator.

### HYMENOPTERA.

**Tenthredinidæ.**
*Entodecta pumila* Klug, a sawfly; Europe; mines in leaves.

**Cephididæ.**
*Janus fumipennis* Ever.; Europe; mines in stems.

## BOX.

(*Buxus* spp. Family Euphorbiaceæ.)

Evergreen shrubs or small trees commonly used for hedges, occurring natively in Central and Eastern Asia, North Africa, Europe, and Central America, and much used in this country.

### IMPORTANT INSECT ENEMIES OF BOX.

HEMIPTERA.

**Coccidæ:**
Unarmored—
*Eriococcus buxi* Fonscolombe; Europe.

DIPTERA.

**Itonididæ (Cecidomyiidæ).**
* *Monarthropalpus buxi* Laboulbene; Europe, eastern United States; leaf miner.

## BROOM CORN.

(See Sorghum.)

## BRUSSELS SPROUTS.

(See Cabbage.)

## BUCKTHORN.

(*Rhamnus* spp. Family Rhamnaceæ.)

Ornamental deciduous or evergreen shrubs or trees propagated from seed or cuttings. The genus occurs chiefly in the northern temperate regions, but some species are found in Brazil and South Africa. The wood of *R. frangula* is made into charcoal valued for the manufacture of gunpowder.

### IMPORTANT INSECTS ATTACKING BUCKTHORN.

HEMIPTERA.

**Coccidæ.**
*Lecanium ciliatum* Douglas; Germany, Tyrol; attacks *Rhamnus alaternus*, and *R. frangula*.
*Chionaspis salicis* Linnæus; Austria; attacks *R. frangula*.
A number of scales already in the United States also attack *Rhamnus*.

LEPIDOPTERA.

**Cossidæ.**
**Zeuzera pyrina* Linnæus; Europe, Africa, N. America, bores in wood. (See Horse-chestnut.)

**Lymantriidæ.**
*Dasychira pudibunda* Linnæus, a defoliator; Europe. (See Forests.)
**Lymantria monacha* Linnæus, the nun moth; Europe; defoliator. (See Forests.)

**Hyponomeutidæ.**
*Hyponomeuta padi* Zeller, a web worm; Europe; attacks *R. frangula*.
*Hyponomeuta evonymella*, a web worm; Europe.

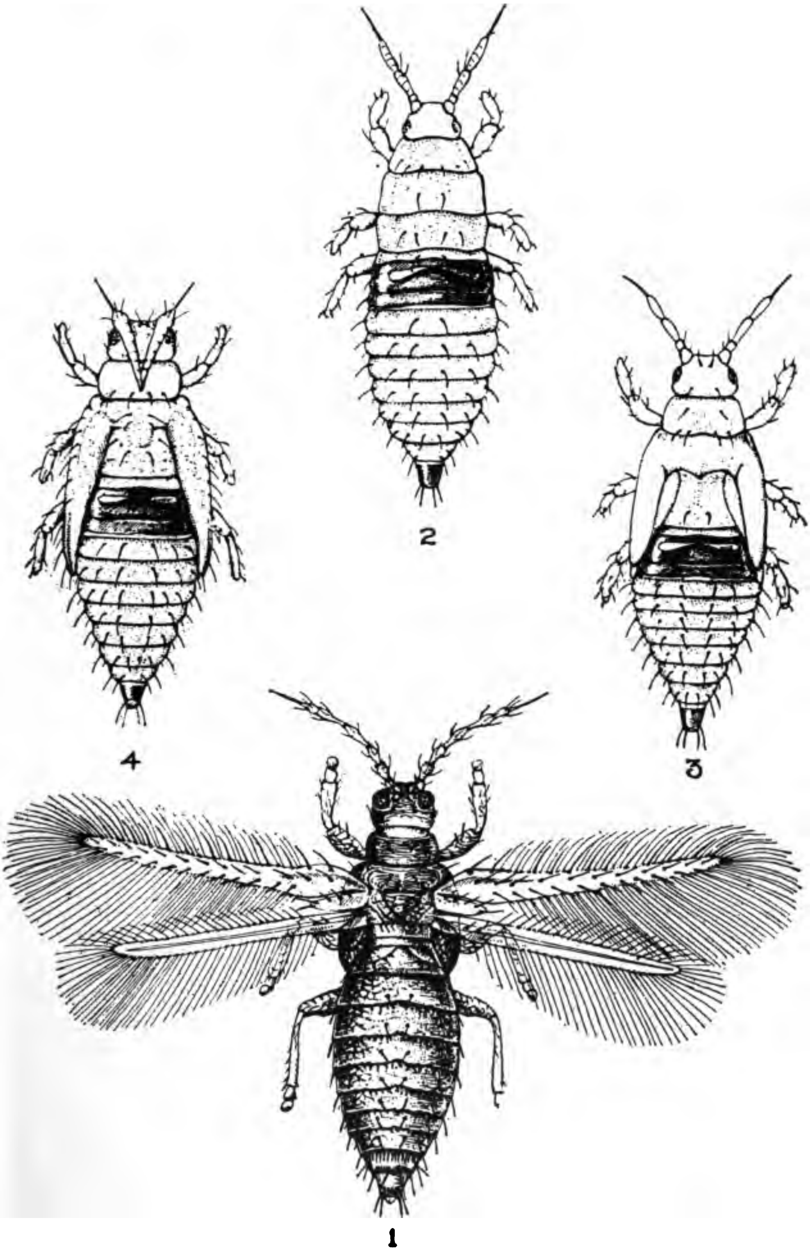
LITERATURE.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
HESS, R. Der Forstschutz, 1900, vol. 2.
LINDINGER, L. Die Schildläuse (Coccidæ), 1912.

## CABBAGE; KALE; COLLARD; BRUSSELS SPROUTS; CAULIFLOWER; KOHLRABI.

(*Brassica oleracea* Linnæus, varieties. Family Cruciferæ.)

The many varieties of this species especially in Europe, have very important pests, which it is not desirable to have imported into this country. Since the flower head is used in some varieties, the foliage in others, and the roots in others, there is danger of importing almost any pest of the species.



THE RED-BANDED THRIPS.

The red-banded thrips (*Heliothrips rubrocinctus*): FIG. 1.—Adult. FIGS. 2-4.—Nymphal stages (Russell.)

## A. BETTER KNOWN CABBAGE PESTS LIKELY TO BE IMPORTED.

### **Contarinia torquens** Meijere.

(Cabbage Midge. Itonididæ [Cecidomyidæ]; Diptera.)

*Hosts:* Cabbage.

*Injury:* Attacks young cabbage plants, especially, breeding in the leaf axil and hindering growth. Has several generations. Pupates in soil.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 447.

### **Dasyneura brassicæ** Winner.

(Cabbage Gall Midge. Itonididæ [Cecidomyidæ]; Diptera.)

*Hosts:* Cabbage, rape.

*Injury:* Breeds in fruit.

*Description and biology: Fly* blackish brown, thorax covered with pubescence giving a silvery sheen, abdomen flesh red, with black bands; length 1.2–1.5 mm. long, milk white. Forms a gall in the fruit, feeds on the seed.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 454.

### **Phaonia trimaculata** Bouché.

(Cabbage Maggot. Anthomyiidæ; Diptera.)

*Hosts:* Cabbage.

*Injury:* Breeds in the roots.

*Description and biology: Fly* light gray, four black interrupted streaks and three brown spots on thorax; eyes hairy; length 8 mm. *Maggot* 11 mm. long.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 432.

## B. IMPORTANT CABBAGE PESTS.

### ORTHOPTERA.

**Gryllotalpidæ.**

**Scapteriscus didactylus* Latreille; Porto Rico, Georgia; quite injurious, cuts below surface of soil.

### COLEOPTERA.

**Elateridæ.**

*Agriotes lineatus* Linnæus. (See Tobacco.)

**Chrysomelidæ.**

*Psylliodes chrysocephala* Linnæus and *P. napi* Fabricius. (See Rape.)

**Brachyrhinidæ.**

**Barynotus squamosus* Germar; Europe, Canada; adults strip plants to ground.

**Curculionidæ.**

*Baris glabra* Herbst, *B. chlorizans* Germar, *B. opiparis* Duval; Europe; breed in root and stem.
*Baris cœrulescens* Scopoli; Europe; breeds in stem.
*Baris lepidii* Germar, and *B. viridisericea* Goeze; Europe; breeds in root and crown.
*Ceutorhynchus cyanipennis* Germar, and *C. sulcicollis* Paykull; Europe; breeds in crown.
*Ceutorhynchus quadridens* Panzer; Europe; breeds in roots.

### LEPIDOPTERA.

**Pieridæ.**

*Pieris monuste* Linnæus, Porto Rico, southern United States; cabbage worm.

**Pyralidæ.**

*Evergestis extimalis* Sc. (See Rape.)

**Plutellidæ.**

*Plutella maculipennis* Curtis; cosmopolitan; destructive to leaves.

**Noctuidæ.**

*Mamestra oleracea* Linnæus and *M. brassicæ* Linnæus; **Europe**; very destructive to cabbage. (See text fig. 29.)

DIPTERA.

**Anthomyiidæ.**

* *Chortophila fusciceps* Zetterstedt. (See Corn.) *Anthomyia radicum* Meigen; Europe. (See Radish.)

## CACAO; CHOCOLATE.

(*Theobroma* spp. Family Sterculiaceæ.)

Cacao is a very important article of commerce entering the United States. It is not grown in the United States proper, but is to a small extent produced in Porto Rico, Hawaii, and the Philippines.

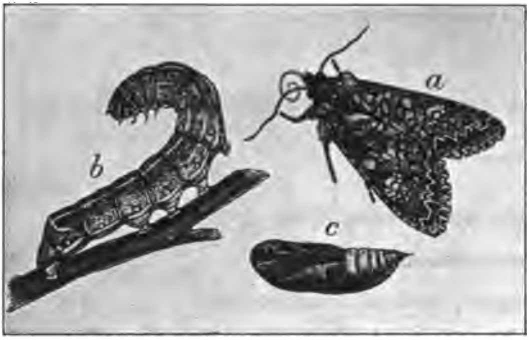


FIG. 29.—The cabbage moth (*Mamestra brassicæ*): *a*, Moth; *b*, larva; *c*, pupa. About natural size. (Curtis.)

### A. AN IMPORTANT CACAO PEST LIKELY TO BE IMPORTED.

**Zaratha cramerella Sn.**

(Cacao moth. Gelechiidæ; Lepidoptera.)

*Hosts:* Cacao, *Nephelium lappaceum.*

*Injury:* Very destructive to the fruit.

*Description and biology: Moth* small. *Larva* 10–12 mm. long, whitish, with greenish shimmer. *Pupa* in oval flattened woolly cocoon on outside of fruit, leaves, and twigs.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 266.

### B. OTHER IMPORTANT CACAO PESTS.

THYSANOPTERA.

* *Heliothrips rubrocinctus* Giard; West Indies, Ceylon, Uganda, Florida (see pl. X).

HEMIPTERA.

**Coccidæ.**

*Philephedra theobromæ* Green; Trinidad, *Theobroma cacao.*

**Miridæ.**

*Helopeltis theivora* and *H. antonii;* Ceylon and Java: *Sahlbergella singularis;* Kamerun.

COLEOPTERA.

**Scarabæidæ.**

*Adoretus umbrosus* Fabricius, and var. *tenuimaculatus* Waterhouse; Hawaii, Japan, Philippine Islands, Java. (See Rose.)

**Buprestidæ.**

*Chrysochroa bicolor* Fabricius, and *C. fulminans* Fabricius; Java; borers.

**Cerambycidæ.**

*Epepeotes luscus* Fabricius; Java; caoutchouc, cacao, mango.
*Monohammus fistulator* Germar; Java, Sumatra, Borneo; coffee, cacao (bores in bark, wood, and fruit).
*Monohammus ruspator* Fabricius; Kamerun; cacao.
*Tragocephala senatoria* Th.; Kamerun; cacao
*Moecha adusta* Har.; West Africa, East Africa; cacao, *Kickxia.*
*Praonetha melanura* Pascoe; Java; cacao, coffee.
*Ecthœa quadricornis* Olivier; Trinidad; cacao.
*Steirastoma depressum* Linnaeus; West Indies, South America; cacao, silk cotton tree (*Ceiba*), okra, etc.
*Glenea novemguttata* Castelnau, Java; cacao

**Chrysomelidæ.**

*Crepidodera costatipennis* Jacoby; Kamerun; defoliator.

LEPIDOPTERA.

**Pyralidæ.**
*Dichocrocis punctiferalis* Guénée; Orient. (See Corn.)

**Notodontidæ.**
*Stauropus alternus* Walker; India, Ceylon, Java; defoliator.

**Cossidæ.**
*Zeuzera coffeæ* Nietner; Asia, Africa. (See Coffee )

DIPTERA.

**Trypetidæ.**
*Ceratitis punctata* Wiedemann; Africa; fruit fly. (See Fruit )
*Ceratitis anonæ* Graham; Africa. (See Fruit.)

LITERATURE.

Guppy, P. L. West Indian Bulletin, 1912, vol. 12, pp. 310–320.
Agricultural News, Barbados, 1915, vol. 14, pp. 58, 59.

## CANTELOUPE.

See Cucurbits.

## CARROT.

(*Daucus carota* Linnæus. Family Umbelliferæ.)

The carrot is grown throughout the world. As it is a root crop there is always danger of introducing root pests.

### IMPORTANT CARROT INSECTS.

COLEOPTERA.

**Elateridæ.**
*Agriotes lineatus* Linnæus. (See Tobacco.)

**Brachyrhinidæ.**
*Cneorhinus plagiatus* Schall.; England.

**Curculionidæ.**
*Liparus coronatus* Goeze; Europe; breeds at roots
*Hypera pastinacæ* Rossi var. *tigrina* Boheman, *H. fasciculata* Herbst, and *H. rogenhoferi* Fairmaire; Europe; breed on the leaves like the clover weevil, *Hypera punctata*.

LEPIDOPTERA

**Œcophoridæ.**
*Depressaria nervosa* Hw.; Europe; very injurious to flower heads.

DIPTERA.

**Agromyzidæ.**
*Phytomyza affinis* Fallen. (See Tobacco.)

## CASSAVA; TAPIOCA; CEARA RUBBER.

(*Manihot utilissima* Pohl., etc. Family Euphorbiaceæ.)

Cassava (*M. utilissima*) is a tropical plant, grown to a limited extent in the southern United States. As it is propagated from cuttings, there is always danger of introducing serious pests when cuttings are imported. A recent shipment of cuttings from Brazil for propagation in this country was badly infested by a stalk-boring weevil *Leiomerus granicollis* Pierce (see Proc. U. S. Nat. Mus., vol. 51, No. 2159, pp. 469-471).

Ceara rubber (*M. glaziovii*) is also an important plant.

## CATALPA.

(*Catalpa* spp. Family Bignoniaceæ.)

Deciduous ornamental trees of North America, and East Asia; much cultivated in this country. The wood is valued for railway ties and fence posts.

### IMPORTANT CATALPA INSECTS.

#### HEMIPTERA.

**Coccidæ:**

Armored—

*Diaspis pentagona* Targioni-Tozzetti; Europe, Asia, Australia, Pacific Islands, Africa, South America eastern United States; attacks fruits and many other plants.

#### LITERATURE.

LINDINGER, L. Die Schildläuse (Coccidæ), 1912.

## CAULIFLOWER.

(See Cabbage.)

## CEDAR.

(*Cedrus* spp. Family Juniperaceæ.)

Large evergreen trees of North America, North Africa, Asia Minor, and the Himalayas, highly valued for their durable and fragrant wood.

### INSECTS INJURIOUS TO CEDAR (CEDRUS).

#### COLEOPTERA.

**Buprestidæ.**

*Sphenoptera aterrima* Kerremans; India; bores in bast and sapwood of deodar (*Cedrus deodara*).
*Sphenoptera lafertei* Thomson; India; deodar.

**Tenebrionidæ.**

*Camarimena rugosistriatus* Blair; India; deodar

**Cerambycidæ.**

*Teledapus dorcadioides* Pascoe; India; bores in trunk of deodar.
*Strongylurus thoracicus* Pascoe; Australia; white cedar.
*Tetropium oreinum* Gahan; India; deodar.
*Trinophylum cribratum* Bates; India; deodar.

**Brachyrhinidæ.**

*Brachyxystus subsignatus* Faust; India; defoliates deodar.

**Cossonidæ.**

*Rhyncholus himalayensis* Stebbing; India; bores in wood of deodar

**Scolytidæ.**

*Polygraphus major* Stebbing; India; bores in deodar.
*Polygraphus aterrimus* Strohmeyer; India; deodar.
*Cryphalus deodara* Stebbing; India; deodar stems.
*Cryphalus himalayensis* Stebbing; India; deodar stems.
*Ips stebbingi* Strohmeyer; India; deodar stems.
*Pityogenes coniferæ* Stebbing; India; deodar.
*Scolytus major* Stebbing, *S. minor* Stebbing and *S. deodara* Stebbing; India; deodar.

**Platypodidæ.**

*Crossotarsus coniferæ* Stebbing; India; deodar.

#### LEPIDOPTERA.

**Pyralidæ.**

*Euzophera cedrella;* India; infests cones of deodar.
*Phycita abietella;* India; infests cones of deodar.

## CELERY.

(*Apium graveolens.* Family Umbelliferæ.)

A garden vegetable much cultivated for its edible stems.

### A. A CELERY PEST LIKELY TO BE IMPORTED.

**Acidia heraclei** Linnæus.

(Celery Fly. Trypetidæ; Diptera.)

*Hosts:* Celery, parsnip, *Heracleum*, *Angelica*, *Ligusticum*, *Arctium*, *Artemisia*, *Rumex*.

*Injury:* Mines leaves and stems, causing considerable injury.

*Description and biology: Fly* brownish yellow, scutellum dark, hind part of thorax and abdomen shining black; head and antennæ reddish yellow; length 5–6.5 mm. *Maggot* whitish. Pupates either in the leaf or in the soil (winter).

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 420, 421.

### B. OTHER IMPORTANT CELERY PESTS.

LEPIDOPTERA.

**Pyralidæ.**

*Pionea forficalis* Linnæus and **P. ferrugalis* Hübner; Europe. (See Cabbage.)

DIPTERA.

**Agromyzidæ.**

*Phytomyza affinis* Fallen. (See Tobacco.)

## CHERRY.

(See Plum.)

## CHESTNUT.

(*Castanea* spp. Family Cupuliferæ.)

Deciduous trees and shrubs of America, Europe, Asia, and North Africa, producing edible nuts. The coarse-grained wood is much used for furniture, railway ties, and fence posts, as it is very durable in the soil.

### A. BETTER KNOWN CHESTNUT INSECTS LIKELY TO BE IMPORTED.

**Curculio elephas** Gyll. (**Balaninus**).

(Chestnut Weevil. Curculionidæ; Coleoptera.)

*Host:* Chestnut.

*Injury:* To chestnut fruit. Not easy to introduce.

*Description and biology.—Adult* length 6–7.5 mm. A long egg-shaped beetle, reddish yellow brown and covered with whitish scales. *Pupates* in ground. *Larva* feeds in fruit of chestnut. *Eggs* placed by female in nut.

*Distribution:* Europe.

HENSCHEL, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 91.

**Laspeyresia splendana** Hübner. (**Carpocapsa.**)

(Nut Fruit Tortrix. Tortricidæ; Lepidoptera.)

*Hosts:* Chestnut; walnut; acorns.

*Injury:* Attacks the nuts, often quite destructive.

*Description and biology.—Adult* wing expanse 12–18 mm.; forewings whitish gray; basal patch gray, streaks of gray along costa; a large blackish brown area inclosing a silver-edged ocellated patch, in which are three or four black, longitudinal lines. Occurs in June and July. *Pupation* similar to that of codling moth. *Larva*, pinkish white; leaves fruit late in fall. *Eggs* deposited on young fruit, hatching in 10 days. (See text fig. 30.)

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 309.

### B. IMPORTANT CHESTNUT INSECTS.

HEMIPTERA.

**Coccidæ.**

Unarmored.

*Lecanium pulchrum* King; Germany, France.

COLEOPTERA.

**Anobiidæ.**

*Xestobium rufovillosum* DeGeer; Europe; bores in wood.

**Bostrychidæ.**

*Bostrychus capucinus* Linnæus; Europe; bores in lumber and barrel staves.

**Scarabæidæ.**

*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus; Europe; larvæ injure roots of seedlings.

**Cerambycidæ.**

*Callidium æneum* DeGeer; Germany; bores in wood of felled trees and lumber.

**Chrysomelidæ.**

*Pseudocolaspis indica* Baly; India; adults destructive to inflorescence of *Castanea vesca*.

**Scolytidæ, Ipidæ.**

*Anisandrus dispar* Fabricius; Germany; galleries in wood.
*Dryocœtes villosus* Fabricius; Germany; galleries in bark.
*Scolytus mali* Bechst.; Europe; galleries in cambium.

### LEPIDOPTERA.

**Tineidæ.**

*Tischeria complanella* Hübner; Europe; leaf miner on *Castanea vesca*.

**Tortricidæ.**

*Tortrix viridana* Linnæus; Europe; feeds on buds and leaves of *Castanea vulgaris*.
*Laspeyresia grossana* Haworth; Europe. (See Beech.)

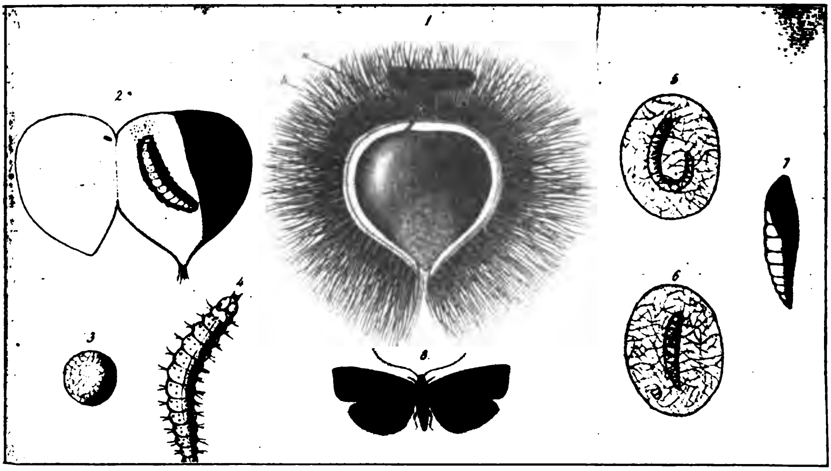


FIG. 30.—Nut fruit tortrix (*Laspeyresia splendana*): 1. Position of egg in chestnut stem; 2, larva in nut; 3, eggs; 4, larva; 5, larva in cocoon; 6, pupa in cocoon; 7, pupa; 8, adult. (Costa.)

### LITERATURE.

LINDINGER, L. Die Schildläuse (Coccidæ), 1912.
HESS, R. Der Forstschutz, 1898, 1900.
SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.

## CHICORY; SUCCORY.

(*Cichorium intybus* Linnæus. Family Compositæ.)

The greater part of the chicory root used in this country is imported from Europe, although a small quantity is raised in the United States. Importations of roots might very easily introduce pests.

## CHINABERRY; UMBRELLA TREE.

(*Melia azedarach.* Family Meliaceæ )

The common chinaberry tree of the South originated in India. It has been introduced into the Imperial Valley, California.

COLEOPTERA.

**Platystomidæ (Anthribidæ).**

**Aræcerus fasciculatus* DeGeer; a cosmopolitan insect, breeds commonly in the berries. This is a pest of many dried vegetable products and is very injurious in the Southern States.

## CHOCOLATE.

(See Cacao.)

## CINCHONA; QUININE.

(*Cinchona.* Family Rubiaceæ.)

South American trees whose bark yields the quinine of medicine.

### A. AN IMPORTANT CINCHONA PEST.

**Boarmia crepuscularia** Hübner.

(Javan Cinchona Geometrid. Geometridæ; Lepidoptera.)

*Hosts:* *Cinchona ledgeriana;* elm.

*Injury:* Very injurious to cinchona in Java; attacks elm in Russia.

*Description and biology:* The larva attacks not only the foliage, but the bark of twigs and young branches, absolutely defoliating a tree when serious.

*Distribution:* Java, Europe, Asia.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 338.

### B. OTHER CINCHONA INSECTS.

LEPIDOPTERA.

**Cossidæ.**

*Zeuzera coffeæ* Nietner; Orient. (See Coffee.)

**Psychidæ.**

*Clania variegata* Snellenhœven, and *C. crameri* Westwood; Orient. (See Tea.)

**Lasiocampidæ.**

*Odonestis plagifera* Walker; Java; defoliator.
*Metanastria hyrtaca* Cresson; Java, very important defoliator.

**Lymantriidæ.**

*Euproctis flexuosa* Snellenhœven; Orient; defoliator.

## CITRUS; ORANGE; LEMON; KUMQUAT; LIME; TANGERINE; GRAPEFRUIT.

(*Citrus* spp. Family Rutaceæ.)

Aromatic, glandular shrubs and trees cultivated in semitropical and tropical countries for their delicious fruits.

### A. CITRUS PESTS LIKELY TO BE IMPORTED.

* **Eriophyes oleivorus** Ashmead.

(Orange Rust Mite; Lemon Silver Mite. Eriophyidæ; Acarina.)

*Hosts:* Orange, lemon.

*Injury:* Blisters the leaves and fruit.

*Description and biology:* Four-legged blister mite which attacks citrus trees and causes rusts on the fruit.

*Distribution:* North America, South America, Bermudas, Australia.

Marlatt, C. L. U. S. Dept. Agr., Yearbook, 1900, pp. 285–289.
Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 121.

### Bemisia giffardi Kotinsky (Aleyrodes).

(Giffard White Fly. Family Aleyrodidæ; Hemiptera.)

*Host:* Citrus.

*Injury:* Frequently abundant on citrus leaves, exuding honeydew copiously, which forms a medium for the development of sooty fungus.

*Description and biology:* Adult female about 0.69 mm. long. Pupa case greenish with purplish red eyes, about 1.26 mm. long and 0.63 mm. wide. Eggs uniformly dark brown in color, with apparently no pedicel.

*Distribution:* Hawaii. (Supposedly an introduced species.)

Kotinsky, J. Bd. Agric. and Forestry, Hawaii, Div. Entom., Bul. 2, 1907, p. 94.
Quaintance and Baker. Journ. Agric. Research, Vol. VI, p. 459 (1916).

### Aleurocanthus woglumi Ashby.

(Spiny citrus white fly. Family Aleyrodidæ; Hemiptera.)

*Hosts:* Orange, *Capparis roxburghi*, *Capparis pedunculosus*, *Citrus* sp., *Morus* sp., *Salacia reticulata*, *Kurrimia zeylanica*, *Guaiacum officinale*, and *Cestrum nocturnum.*

*Injury:* Infests the lower surface of the leaves.

*Description and biology:* Immature stages black, spiny. *Pupa case* about 1.4 by .89 mm., elliptical; dorsum attached; eggs very small yellowish, sometimes reticulated.

*Distribution:* India, Ceylon, Philippine Islands, Jamaica, Bahama and Cuba.

### Aleurothrixus porteri Quaintance and Baker.

(Porter's white fly. Family Aleyrodidæ; Hemiptera.)

*Hosts:* Orange, Solanaceous plants, *Schinus dependens*, *Schinus molle*, Jaboticaba, *Lippia citriodora*, and *Myrtus.*

*Injury:* Infests the lower surface of foliage.

*Description and biology: Pupa case* .88 by .50 mm., elliptical; dorsum somewhat elevated, covered with cottony wax; the abdomen with a distinct keel; margin incised. Adults yellow with dark brown eyes. Length, .88 mm., forewing 1.04 mm. long, without markings, but often uniformly clouded with dusky.

*Distribution:* Chile and Brazil.

### Apate monachus Fabricius.

(Bostrychidæ; Coleoptera.)

*Hosts:* Orange, plum, almond, coffee, avocado.

*Injury:* Very injurious. Bores in wood.

*Description and biology: Larva* bores in bark and heartwood; sap and twigs in neighborhood of galleries blackened.

*Distribution:* East and West Africa, Antilles, Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 490.

### Leptostylus præmorsus.

(Bark-borer. Cerambycidæ; Coleoptera.)

*Host:* Citrus trees.

*Injury:* Attacks the stems near the ground or at the point of pruning, resulting in the ultimate death of the tree. May be introduced in nursery stock.

*Description and biology: Adult* brownish with long slender antennæ. Eggs are quite likely laid in dead or dying portions of tree after pruning.

*Distribution:* Lesser Antilles.

Ballou, H. A. Insect Pests of the Lesser Antilles, 1912, p. 81.

**Prays citri Miller.**

(Philippine Orange Moth. Hyponomeutidæ; Lepidoptera.)

*Host:* Orange, lemon, lime, mandarin, and cabuyao.

*Injury:* Injures the blossoms of orange and lemon.

*Biology:* Eggs deposited in the calices or peduncle of the flower; larvæ upon hatching bore through the inclosing parts, often destroying the calyx, pistil, and ovules; pupate within the flower and also in leaves or forks of twigs or branches. C. F. Baker states that in the Philippine Islands "the larva of this moth lives just beneath the rind next to, but not in, the pulp. They produce the gall-like tumors which remain open at the tips. The adult moths are of two sizes."

*Distribution:* Sicily, Italy, Corsica, Ceylon, Australia, Philippines.

Essig, E. O. California State Board of Horticulture, Monthly Bul., vol. 2, 1913, No. 11, p. 722.

Silvestri, F. Dispense di Entomologia Agraria, 1911, p. 287.

Quayle, H. J. U. S. Dept. Agric., Bul. 134, 1914, p. 22.

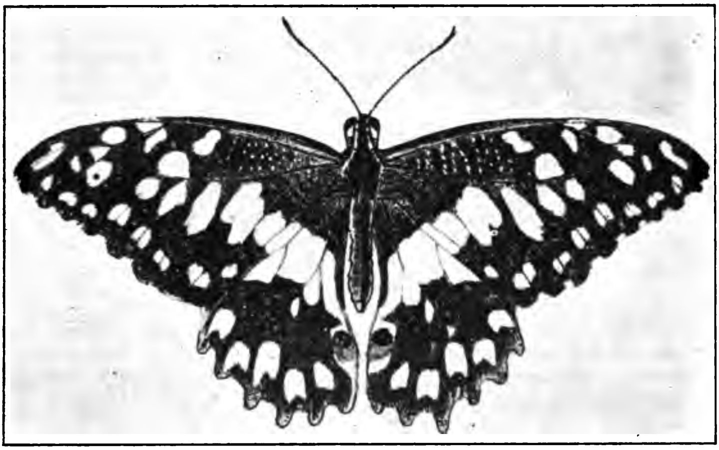


FIG. 31.—Lemon butterfly (*Papilio demoleus*). (Maxwell-Lefroy.)

Wester, P. J. Dept. Public Instruction, Bur. Agric., Manila, P. I., 1913, Bul. 27, p. 60.

**Papilio demoleus Linnæus.**

(Lemon caterpillar. Papilionidæ; Lepidoptera.)

*Hosts:* Orange, lime, lemon, and other citrus trees.

*Injury:* Defoliates citrus trees and is one of the commonest butterflies in India.

*Biology:* Eggs yellow and deposited on topmost shoots of the plant. On hatching the larvæ are brown with white markings; when fully grown the color changes to a vivid green with lateral brown markings. Pupate on the plant. Adults large and conspicuous. (See text fig. 31.)

*Distribution:* India and South Africa.

Maxwell-Lefroy, H. The Agric. Journ. of India, 1908, vol. 3, p. 239.

Maxwell-Lefroy, H. Indian Insect Pests, 1906, p. 174.

**Nephopteryx sagittiferella Moore.**

(Perak Pomelo Moth. Phycitidæ; Lepidoptera.)

*Hosts:* Pomelo, lime, lemon.

*Injury:* Reported to be very destructive to pomeloes in the residency gardens at Kwala Kangsa. May be introduced in the soil.

*Biology:* Eggs laid singly on underside of fruit; caterpillars, on hatching, penetrate fruit, increasing size and number of galleries as each successive stage is passed; pupate in ground and emerge as adults in about 12 days.

*Distribution:* India, Europe (?).

Cotes, E. C. Indian Museum Notes, 1891, vol. 2, No. 1, p. 21.

### Phyllocnistis citrella Stainton.

(Citrus Leafminer. Tineidæ; Lepidoptera.)

*Hosts:* Citrus.

*Injury:* Injurious to citrus nursery stock in India, attacking the buds and young foliage. May be introduced in nursery stock in Wardian cases.

*Description and biology: Adult,* head, face, palpi, and legs white, antennæ whitish, anterior wings white with two slender gray streaks, posterior wings whitish with pale gray cilia. Larvæ mine the leaves of young nursery stock, the cocoon is usually placed at the edge of the leaf, which is rolled up.

*Distribution:* India, Philippine Islands.

Woglum. R. S. U. S. Dept. of Agric., Bur. Entom., Bul. 120, 1913, pp. 27, 28, and 40.

### Ceratitis catoirei Guérin.

(Mauritius Fruit Fly. Trypetidæ; Diptera.)

*Host:* Tangerine.

*Injury:* Attacks fruit.

*Description:* Adult female fly 6–7 mm. long; male 5–6 mm.

*Distribution:* Seychelles Islands, Mauritius; Isles of Bourbon.

Froggatt, W. W. Proc. Linn. Soc., New South Wales, 1910, vol. 35, pt. 4, p. 864.

### Dacus æqualis Coquillett.

(Large Australian Fruit Fly. Trypetidæ; Diptera.)

*Host:* Orange.

*Injury:* Larvæ feed on oranges.

*Description:* Adult female length 8–9 mm. (excluding ovipositor). Front margin of wings with broad ferruginous stripe. Antennæ long, and body wasp-shaped.

*Distribution:* New South Wales.

Froggatt, W. W. Dept. Agric., New South Wales, Farmers' Bul. 24, 1909, p. 26.

### Dacus ornatissimus Froggatt.

(Mandarin Fruit Fly. Trypetidæ; Diptera.)

*Host:* Mandarin.

*Injury:* Breeds in fruit.

*Description:* Adult female 6 mm. in length, general color chestnut brown to ocherous, dorsal surface of thorax black, abdomen ocherous with narrow dark indistinct transverse lines. (See plate xxviii, figs. *a*, *c*.)

*Distribution:* New Caledonia.

Froggatt, W. W. Dept. Agric., New South Wales, Farmers' Bul. 24, 1909, p. 28.

## IMPORTANT CITRUS INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—

*Aspidiotus* (*Aonidiella*) *subrubescens* Maskell; New South Wales. Scale of female reddish brown, flat, subcircular, exuvia central forming a slightly elevated boss.

*Aspidiotus* (*Chrysomphalus*) *albopictus* Cockerell; Mexico. Scale of female 2–2.25 mm. in diameter, dark brown and often covered with a white secretion, exuvia central and free of secretion.

*Aspidiotus* (*Chrysomphalus*) *koebelei* Townsend and Cockerell; Mexico. Scale of female 1.5–2 mm. in diameter, circular to suboval, light brown to grayish, exuvia to one side.

*Aspidiotus* (*Chrysomphalus*) *personatus* Comstock; Bermuda. (See Olive.)

**Coccidæ**—Continued.

Armored—Continued.

*Aspidiotus* (*Chrysomphalus*) *scutiformis* Cockerell; Central America, Mexico. Scale of female large, flat, occasionally nearly white, exuvia orange colored and not nipplelike.

*Aspidiotus* (*Diaspidiotus*) *orientalis* Newstead; Cuba, *Poncirus trifoliata* (*Citrus*). Scale of female 1.6–2 mm. in diameter, subcircular, light yellowish brown, exuvia central.

✱*Aspidiotus* (*Pseudaonidia*) *articulatus* Morgan; Barbados (Windward Islands), British Guiana, Costa Rica, Porto Rico, Panama, Ecuador, Venezuela, Nicaragua, Isle of Pines, Trinidad, Cuba, Sicily, Mexico, St. Vincent, Dominica. (See Coffee.)

*Aspidiotus* (*Pseudaonidia*) *clavigera* Cockerell; Hawaii. Scale of female 2.5 mm. in diameter, blackish and usually covered by epidermis of the twigs.

*Aspidiotus* (*Pseudaonidia*) *duplex* Cockerell. Scale of female 2.66 mm. in diameter, subcircular, dark blackish brown, exuvia orange colored and to one side.

*Aspidiotus* (*Pseudaonidia*) *fimbriatus* Maskell; New South Wales. Scale of female 1.5 mm., flat, thin and circular.

*Aspidiotus* (*Pseudaonidia*) *trilobitiformis* Green; East Africa, Japan, Brazil. Scale of female 3–4.5 mm. in diameter, semicircular, reddish brown. (See text fig. 32.)

*Lepidosaphes pinnæformis* Bouché; German East Africa, Canary Islands, Sicily. Scale of female 1.75–2 mm. long, yellowish brown to dusky brown, curved or mytiliform.

*Parlatoria calianthina* Berlese and Leonardi; Italy, Sicily. (See Olive.)

*Parlatoria cinerea* Doane and Hadden; Society Islands on orange. Scale of female circular, slightly convex, pale brownish gray.

*Parlatoria sinensis* Maskell; China on orange. Scale of female usually encrusting twigs.

✱*Parlatoria zizyphus* Lucas; Italy, Sicily, Philippines. Often received on imported lemons. Scale of female black.

Unarmored—

*Akermes punctatus* Cockerell; Grenada; *Citrus medica acida*. Female scale about 3.5 mm. long, hemispherical, pale ochreous.

*Coccus viridis* Green; West Indies, Ceylon, Montserrat. (See Coffee.)

*Coccus hesperidum* Linnaeus; cosmopolitan; citrus, tea, palm. (See pl. II, fig. 4.)

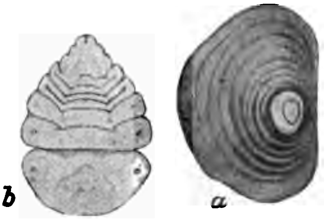


FIG. 32.—Citrus scale (*Aspidiotus* [*Pseudaonidia*] *trilobitiformis*).

*Icerya montserratensis* Riley and Howard; Ecuador, Montserrat, Porto Rico. Female reddish yellow, antennæ and legs black, waxy secretion white, corrugated long wax tufts protrude from the body.

*Icerya seychellarum* Westwood; Seychelles Islands, Mauritius, Madeira, Japan, Madagascar. Female about 5 mm. in length, egg sac snow white, many long silvery hairs on dorsal aspect.

*Orthezia prælonga* Douglas; Jamaica, Trinidad, Brazil, British Guiana. Female long, narrow, pitchy black and covered with snow-white waxy laminations.

✱*Orthezia insignis* Douglas; cosmopolitan; citrus, tea, etc. (See pl. IV, fig. 2.)

*Pseudococcus filamentosus* Cockerell; Jamaica, Japan, Mauritius, Hawaii. Female about 3 mm. long, gray, covered with white secretions, antennæ 7-jointed.

✱*Pseudococcus citri* Risso; citrus, coffee, tobacco, cotton. (See pl. II, fig. 3.)

*Pulvinaria aurantii* Cockerell; Japan. Female usually on underside of leaf, with white ovisac about 5 mm. long, suboval.

*Pulvinaria cellulosa* Green; Ceylon. Female including ovisac 4.5 to 5 mm. in length, ovisac snow white; female shrivels after gestation.

*Takahashia citricola* Kuwana; Japan. Female free from the plant and resting upon the ovisac. Similar to *T. japonica*.

## ISOPTERA.

**Termitidæ.**

*Termes australis* Hagen; Australia. (See Apple.)

## COLEOPTERA.

**Scarabæidæ.**

*Adoretus umbrosus* Fabricius, and var. *tenuimaculatus* Waterhouse; Hawaii, Philippines, Japan, Java.

**Bostrychidæ.**

*Bostrychopsis jesuita* Fabricius; Australia; bores in trees.

**Cerambycidæ.**

*Uracanthus cryptophagus* Olivier; Australia; bores in trunks.

*Acrocinus accentifer* Olivier; Brazil; bores in trunks of orange, tangerine, limes, lemons. (Boletim Agricultura, ser. 15, pp. 1066–1072.)

*Diploschema rotundicolle* Serville; Brazil; girdles and bores in twigs (Bol. Agric., ser. 15, pp. 1073–1081).

**Curculionidæ.**

*Orthorrhinus cylindrirostris* Fabricius; Australia; bores in wood (French, Handbook Destr. Ins. Victoria, pt. 4, p. 82).

*Cratosomus reidi* Kirby; Brazil; bores long tunnels in stems and trunks of orange. (Bol. Agric., ser. 15, pp. 1081–1092.)

*Diaprepes abbreviatus* Linnæus; West Indies. (See Sugar cane.)

### LEPIDOPTERA.

**Pyralidæ.**

*Dichocrocis punctiferalis* Guénée; Queensland. (See Corn.)

**Papilionidæ.**

*Papilio idæus* Fabricius; Brazil; feeds on foliage.

### DIPTERA.

**Trypetidæ.**

*Anastrepha fraterculus* Wiedemann, attacks oranges. (See Fruit.)

*Anastrepha ludens* Loew; Mexico; attacks orange and sweet lime. (See Fruit.)

*Bactrocera tryoni* Froggatt; Orient. (See Fruit.)

*Ceratitis capitata* Wiedemann, attacks *Citrus aurantium*, *C. grandis* (*decumana*), *C. japonica*, *C. limonia* and *C. nobilis*. (See Fruit.)

*Dacus ferrugineus* Fabricius; India, etc. (See Fruit.)

*Dacus diversus* Coquillett; India. (See Fruit.)

*Dacus passifloræ* Froggatt; Fiji; attacks orange, lemon, and lime. (See Fruit.)

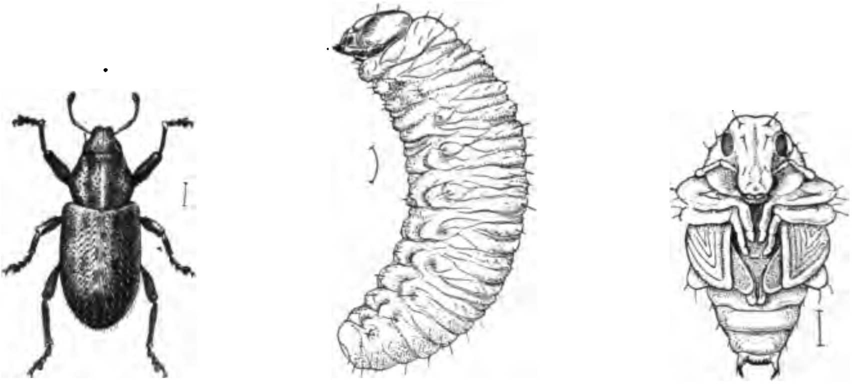


FIG. 33.—The clover-root curculio (*Sitona hispidula*): Adult, larva and pupa. Greatly enlarged (Wildermuth.)

## CLOVER.

(*Trifolium* spp. Family Leguminosæ.)

There are many species of clovers used as forage crops in various parts of the world. Although clover is usually only imported as seed, several very serious foliage pests have been introduced from Europe.

The lasiocampid moth, *Lasiocampa trifolii* Ep., of Europe and Asia Minor, is injurious to clover. Many weevils of the genus Sitona not mentioned below are injurious to clover in Europe. They breed at the roots, but several have been imported into the United States. The weevils of the genus Hypera (Phytonomus) are equally dangerous to clovers. They breed externally on the foliage. Several European species have established strong colonies in this country. The weevils of the genus Apion (e. g. *A. apricans* Herbst) often breed in the heads of clovers and many of them are very dangerous. (For *Agriotes lineatus* Linnæus see Tobacco.)

### Sitona spp.

(Clover root weevils. Curculionidæ; Coleoptera.)

*Species: S. lineata* Linnæus; Europe (England); adults feed on peas, beans, etc., larvæ feed at roots of these and clover and lucerne. ⁎*S. flavescens* Marsh.; Europe, introduced into America; clover, beans, peas, *Galega officinalis*. ⁎*S. hispidula* Fabricius; Europe, introduced into America; clover, peas, *Galega officinalis*. (See text fig. 33.) *S. linneellus* Gyllenhal; Europe; lucerne. *S. meliloti* Walton; Europe, *Melilotus officinalis* Derr. *S. sulcifrons* Thunberg; Europe; clover, *Atriplex hastata* L.

*Description:* Elongate grayish or brownish weevils with short blunt beak. The larvæ breed at the roots of plants and in nodules. Important pests.

BARGAGLI, P. Rassegna Biologica Rincofori Europei, 1883–1887.

### * Miccotrogus picirostris Fabricius.

(Imported clover weevil. Curculionidæ; Coleoptera.)

This is a recently imported weevil which attacks clover in New England. (See text fig. 34.)

### Hypera (Phytonomus) spp.

(Clover-leaf weevils. Curculionidæ; Coleoptera.)

*Species:* **H. punctata* Fabricius; Europe, introduced into America; clover, and alfalfa. **H. meles* Fabricius; Europe, introduced into America; clover, alfalfa, grasses. **H. nigrirostris* Fabricius; Europe; introduced into United States; clover, alfalfa, *Ononis*, etc. *H. miles* Paykull, Europe; clover. *H. murina* Linnæus; Europe; alfalfa, clover. *H. variabilis* Herbst; Europe; clover, beans, cabbage, raspberry, potato. *H. ononidis* Chevrolat; Europe; clover, *Ononis viscosa*.

*Injury:* These are all serious or potential pests and easily distributed. (See Alfalfa.)

*Description and biology:* The clover-leaf beetle, *H. punctata*, is very familiar to most entomologists in this country. The other species are of similar form but different colors of brown, gray, or green. The larvæ feed externally on the leaves and pupate in silken cocoons.

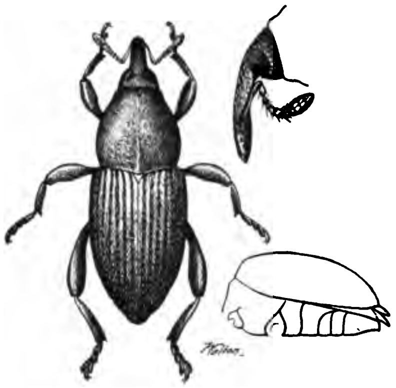


FIG. 34.—Imported clover weevil (*Miccotrogus picirostris*): Adult, enlarged. (Original, Walton.)

BARGAGLI, P. Rassegna Biologica Rincofori Europei, 1883–1887.

## COCONUT PALM.

(*Cocos nucifera.* Family Palmaceæ.)

A large palm cultivated for ornament and for its edible fruit. It is grown in Florida and California as an ornamental tree. (See Palms.)

## COFFEE.

(*Coffea arabica* Linnæus; *Coffea liberica* Hiern. Family Rubiaceæ.)

Coffee is grown in Africa, Asia, Central America, South America, and many of the islands of the Pacific and Atlantic. Although not grown in the United States proper, it is an important product of Porto Rico, Hawaii, and the Philippines. The importations of the beans into this country are enormous. Where beans or seedlings are imported into the Territories above mentioned, there is danger of introducing noxious insects.

## A. BETTER KNOWN COFFEE INSECTS.

### Tetranychus bioculatus Wood-Mason.

(Coffee Red Spider. Tetranychidæ; Acarina.)

*Host:* Coffee, tea, tomato, *Firmiana colorata*, *Anthocephalus cadamba*.

*Injury:* Injures plant by sucking juices. May be easily imported on nursery stock and might attack other crops if introduced.

*Description and biology:* A tiny red spider very like the common red spider of this country and likely to be as dangerous.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913. vol. 3, p. 97.
COTES, E. C. Indian Museum Notes, 1896, vol. 3, pp. 48–56, 2 figs.

### Xyleborus coffeæ Wurth.

(Coffee Beetle. Scolytidæ; Coleoptera.)

*Hosts: Coffea arabica, C. robusta,* and *C. liberica, Erythrina lithosperma, Melia azedarach, Cacao, Cinchona ledgeriana.* Occasionally feeds on *Hevea brasiliensis,* although the sticky excretion of the plant catches and holds the beetles, resulting in their death.

*Injury:* Considered injurious to *Coffea robusta,* and it is recommended that this plant be discontinued in order to drive the insects to bruised or injured *Hevea brasiliensis.*

*Description and biology:* Adult male beetle 1.1 mm. long and 0.55 mm. broad; adult female 1.6 mm. long and 0.8 mm. broad; color shining brown. Bores in galleries in the wood.

*Distribution:* Dutch East Africa, Java, Tonkin.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 574.

### Zeuzera coffeæ Nietner.

(Red Coffee Borer. Cossidæ; Lepidoptera.)

*Hosts:* Coffee, tea, cacao, cinchona, *Acalypha marginata, Anona muricata, Durantha, Grevillea, Persea gratissima, Photinia, Santalum album, Swietenia mahagoni,* cotton.

*Injury:* Bores in the wood or stalks.

*Description and biology: Moth* wing expanse 40–46 mm., head and thorax gray, with black spots; wings white with blue black spots, abdomen black with white hair. Bores in the wood. *Pupates* in larval bore near exterior. The pupa emerges partially before escape of moth.

*Distribution:* India, Ceylon, Java, Kamerun (German East Africa).

SORAUER, P. Handbuch der Pflanzenkrankheiten, ed. 3, vol. 3, 1913, p. 321.
MAXWELL-LEFROY, H. M. Mem. Dept. Agric. India, vol. 1, 1907, p. 156, fig. 41.

### Leucoptera coffeella Stainton.

(Coffee Leaf Miner. Lyonetiidæ; Lepidoptera.)

*Host:* Coffee.

*Injury:* Is said to have caused a loss of about 20 per cent of the crop in Brazil, 20 to 30 per cent of the leaves infested in Porto Rico, and a serious enemy in Cuba. Considered the worst of all coffee pests. Likely to be introduced on plants.

*Description and biology:* Adult moth 2.5 mm. long, silver gray color, tipped with black on posterior end. Eggs deposited in small slits made in the leaves; the larvæ hatch within 4 to 6 days, live within the leaf about 3 weeks, and then leave the interior of the leaf through the upper epidermis and form a web, pupating on under surface of the leaf. The adult hatches in from 3 to 7 days.

*Distribution:* Porto Rico, Brazil, Cuba.

COOK, M. T. Est. Centr. Agron. de Cuba, Bul. 3, 1905.

## B. OTHER IMPORTANT COFFEE INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—

**Aspidiotus* (*Pseudaonidia*) *articulatus* Morgan; Venezuela, Jamaica, British Guiana. Adult female 2–2.25 mm. in diameter, semitransparent, pale brown or yellowish.

*Lepidosaphes corrugata* Green; Java. Adult female, scale 3–4.5 mm. in length, 1 mm. broad, dull black, thick, opaque, with many curved transverse corrugations.

Unarmored—

*Asterolecanium coffeæ* Newstead; German East Africa. Liable to be introduced on leaves and twigs. Adult female, test golden yellow, margin fringed with golden yellow glassy filaments; test of old specimen opaque grayish with bottle-green markings.

*Cerococcus ornatus* Green; Ceylon. Liable to be introduced on twigs. Adult female enclosed in test of wax which is purplish brown, on each of the sloping sides are two wax ridges; length 2–2.5 mm.

*Ceroplastes ceriferus* Anderson; German East Africa. On *Coffea arabica*. (See Citrus.)

*Ceroplastes vinsonioides* Newstead; Uganda. Liable to be introduced on leaves and twigs. Adult female, covered with wax, test dark cinnamon to brownish, young female star shaped.

*Coccus viridis* Green; Brazil, Ceylon, India, Mauritius. Liable to be introduced on cuttings and foliage. Adult female 2.5 to 3.25 mm. in length, breadth 1.5 to 2 mm.; pale green with loop of blackish spots on dorsum.

*Lecanium caudatus* Green; Ceylon. Liable to be introduced on cuttings and foliage. Adult female 3–4 mm. in length, 2–3 mm. in breadth; oval, narrowed in front broadly rounded behind, bright, castaneous.

*Ortheziola fodiens* Giard; Guadaloupe. Liable to be introduced on roots. Adult female 2 mm. long, 1.5 mm. broad, tawny red provided with laminations.

*Pseudococcus coffeæ* Newstead; Java; Liberian coffee. Adult female covered with densely felted plates of white secretion.

*Pseudococcus virgatus* Cockerell; Jamaica, Mexico, Hawaii. Liable to be introduced on foliage, branches, or roots. Adult female 4–5 mm. long, white mealy brown above with caudal filaments about half the length of the body; antennæ 8-jointed.

*Pulvinaria camelicola* Signoret; Hawaii. Adult female 2–3 mm. in length, ovisac from four to eight times length of insect.

*Pulvinaria ficus* Hempel; Montserrat, Antigua, St. Kitts. Adult female length 5 mm., width 2.25 mm.; ovisac white and fluffy; antennæ 8-jointed.

*Pulvinaria mammeæ* Maskell. Adult female before gestation about 8 mm. long. Ovisac large, snow white, forming a mass of loose cotton.

*Rhizoecus eloti* Giard; Guadaloupe. Liable to be introduced on roots. Adult female elongate, anal tubercles prominent; antennæ 5-jointed.

**Saissetia nigra* Nietner; Costa Rica, Ceylon, India. Liable to be introduced on cuttings and plants. Adult female length 3–5 mm., breadth 2–3 mm.; black, oval, convex with dorsum occasionally forming a pronounced hump; a longitudinal carina is often present.

### THYSANOPTERA.

**Heliothrips rubrocinctus* Giard; West Indies, Ceylon, Uganda, Florida; attacks *Coffea liberica*. (See plate X.)

### COLEOPTERA.

**Bostrychidæ.**

*Apate monachus* Fabricius; Africa, West Indies. (See Citrus.)

**Cerambycidæ.**

*Monohammus fistulator* Germar; Java, Sumatra, Borneo; bores in wood.

*Bixadus sierricola* White; Sierra Leone to Kamerun; very serious borer.

*Coptops fusca* Olivier, *C. bidens* Fabricius, *Baræus sordidus* Olivier, *Sternotomis imperialis* Fabricius, *S. regalis* Fabricius, *Moecha büttneri* Kolbe, *M. molator* Fabricius, and *Frea maculicornis* Thomson; West Africa; bore in wood.

*Anthores asperula* White; East and South Africa; a very serious borer.

*Frea marmorata* Gerstaecker; East Africa.

*Praonetha melanura* Pascoe; Java.

*Nitocris usambica* Kolbe; East Africa; a very injurious borer.

*Xylotrechus javanicus* Lap. et Gory; Java; bores in bark and wood.

*Xylotrechus quadripes* Chevrolat; India, Ceylon, Burma, Siam, Tonkin, Philippines; bores in bark and wood. (See text fig. 35.)

**Brachyrhinidæ (Otiorhynchidæ).**

*Hypomeces curtus* Schönherr; eats the foliage of young plants in Java.

*Pachnæus litus* Germar; breeds at the roots, the larvæ gnawing the bark, in Cuba.

*Pachnæus azurescens* Gyllenhal; breeds at the roots, the larvæ gnawing the bark in Cuba.

**Brachyrhinidæ (Otiorhynchidæ)—Continued.**

*Diaprepes abbreviatus* Linnæus; attacks the foliage and possibly the larvæ attack the roots in the West Indies. (See Sugar cane.)

*Cratopus punctum* Fabricius; feeds on the foliage in Mauritius and Reunion.

*Geonomus quadrinodosus* Chevrolat; feeds as larva on the leaves in Venezuela.

*Rhadinoscopus nocturnus* Kolbe; feeds on the leaves in German East Africa.

**Scolytidæ.**

*Xyleborus morstatti* Hagedorn; German East Africa; bores in Bukoba coffee and *Coffea stenophylla.*

### LEPIDOPTERA.

**Pyralidæ.**

*Thliptoceras octoguttata* Fld.; German East Africa; attacks beans.

**Cochlidiidæ.**

*Parasa lepida* Cr.; Java; serious.

**Psychidæ.**

*Clania crameri* Westwood and *C. variegata* Snellenhoeven; Orient. (See Tea.)

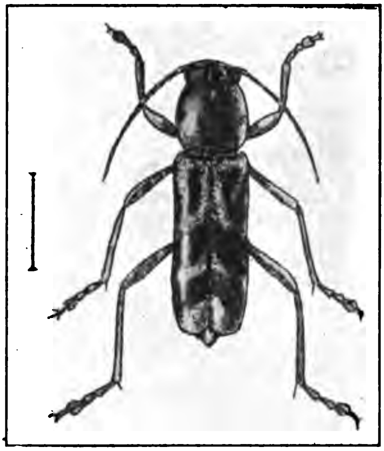


FIG. 35.—Pine bark beetle (*Xylotrechus quadripes*): Adult. (Maxwell-Lefroy.)

**Lymantriidæ.**

*Dasychira mendosa* Hübner, *D. misana* Moore, *D. thwaitesi* Moore and *Orgyia postica* Walker; India, Ceylon, Java; defoliators.

**Notodontidæ.**

*Stauropus alternus* Walker; India, Ceylon, Java; defoliates.

### DIPTERA.

**Trypetidæ.**

*Anastrepha fraterculus* Wiedemann. (See Fruit.)

*Ceratitis capitata* Wiedemann; attacks *Coffea arabica.* (See Fruit.)

## COLLARD.

See Cabbage.

## CONIFERS.

(Family Pinaceæ.)

Under this heading are treated the insect pests of Douglas spruce (*Pseudotsuga*), fir (*Abies*), hemlock spruce (*Tsuga*), larch (*Larix*), pine (*Pinus*), and spruce (*Picea*). This grouping is due to the fact that these trees have so many pests in common and also because of a confusion in foreign and home literature of the names pine, spruce, and fir.

### A. IMPORTANT INSECTS ATTACKING VARIOUS CONIFERS.

**Diadoxus scalaris** Laporte et Gory; **Diadoxus erythrurus** White.

(Cypress Borers. Buprestidæ; Coleoptera.)

*Hosts:* Murray pine (*Pinus frenela*), Lambert's cypress (*Cupressus lambertiana*).

*Injury:* Very destructive to the wood, boring under the bark and into the wood.

*Description: D. scalaris* is the larger species. Both are greenish in color, with the elytra largely reddish brown except for green basal stripes and yellow discal spots. The median line of the thorax is yellow between two black or brown fasciæ. Larvæ yellowish white.

*Distribution:* Victoria, Australia.

FRENCH, C. Handbook of Destructive Insects of Victoria, pt. 5, 1911, pp. 44–50, pls. 106, 107.

### **Tetropium castaneum** Linnæus.

(Spruce Borer. Cerambycidæ; Coleoptera.)

*Hosts:* Larch, spruce, pine, fir.
*Injury:* Bores in the wood.
*Distribution:* Europe, Siberia.

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 136–139, figs. 108, 109 (*T. fuscus, T. luridus*).

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 495.

### **Brachyrhinus (Otiorhynchus spp.).**

(Coniferous Root Weevils. Brachyrhinidæ (Otiorhynchidæ); Coleoptera.)

*Species: B. niger* Fabricius; Europe; pine, larch, spruce, maple, alder, ash, service berry; breeds at the roots and the adults attack the foliage. *B. fuscipes* Olivier; Europe; spruce. *B. perdix* Olivier; Europe; spruce. ✱*B. ovatus* Linnæus; Europe, United States; spruce. A very important pest of strawberries, conifers, and greenhouse plants. *B. singularis* Linnæus; Europe; spruce, fir, and many other plants (see Grape). *B. sensitivus* Scopoli; Europe; spruce, Weymouth pine, Douglas fir. *B. irritans* Herbst; Europe; pine, beech. *B. armadillo* Rossi, *B. aurifer* Boheman, *B. egregius* Miller, *B. fullo* Schrank, *B. inflatus* Gyllenhal, *B. jovis* Miller, *B. lepidopterus* Fabricius, *B. kratterii* Boheman, *B. morio* Fabricius, *B. multipunctatus* Fabricius, and *B. septentrionis* Herbst, are reported on conifers in Europe.

*Description:* Black, oval weevils, with broad blunt beaks. Breed at the roots of plants and are very destructive.

SORAUER, P. Handbuch der Pflanzenkrankheiten, ed. 3, vol. 3, 1913, p. 54.

BARGAGLI, P. Rassegna Biologica Rincofori Europei, 1883–1887.

### **Magdalis spp.**

(Coniferous Weevils. Curculionidæ; Coleoptera.)

*Species:* The weevils of this familiar genus are very destructive to forest trees, breeding under the bark but entering the wood. They are very easily distributed in logs. *M. violacea* Linnæus; Europe; attacks 3 to 10 year old pines, larch, and fir. *M. phlegmatica* Herbst; Europe; spruce and pines. *M. duplicata* Germar; Europe; spruce, *Pinus silvestris*. *M. memnonia* Gyllenhal; Europe; pine. *M. rufa* Germar; Europe; pines and other conifers.

BARGAGLI, P. Rassegna Biologica Rincofori Europei, 1883–1887.

### **Dendroctonus micans** Kugelann.

(The Large Bast Beetle. Ipidæ; Coleoptera.)

*Hosts:* Principally spruce (*Picea*). Occasionally pine.

*Injury:* Quite destructive to trees from breast height down to and including roots.

*Description:* Beetle elongate, nearly dull black, with long gray-yellowish hair not densely set. Wing covers punctate striate, antennæ and legs yellowish red; 8–9 mm. long.

*Evidence of infestation:* Free resin flow out of holes about 3 mm. in diameter. Mixed with boring dust, it hardens in the air in white lumps.

*Distribution:* Germany, France.

NÜSSLIN, O. Leitfaden der Forstinsektenkunde. 1913, pp. 246–249, fig. 211.

JUDEICH, J. F., and NITSCHE, H. Lehrbuch der Mitteleuropäischen Forstinsektenkunde. I, pp. 458–462, 1895.

### **Ips typographus** Linnæus.

(Eight-toothed large spruce barkbeetle or "typographer." Ipidæ; Coleoptera.)

*Hosts:* Spruce; rarely larch and Scotch fir (*Pinus silvestris.*)

*Injury:* Bores in bark and sapwood: while usually secondary, it also attacks healthy trees when very numerous. Recognized as the most dangerous bark-beetle in Europe.

*Description:* Beetle black or brown, cylindrical, 4.5–5.5 mm. long, 8 teeth on margins of elytral declivity, of which the 3d on each side is the largest and with rounded apex.

*Evidence of infestation:* Shows only when the tree begins to react by changing color of foliage.

*Distribution:* Lapland to Alps, wherever spruce grows.

Nüsslin, O. Leitfaden der Forstinsektenkunde. 1913, pp. 269–272, fig. 238.

Judeich, J. F., und Nitsche, H. Lehrbuch der Mitteleuropäischen Forstinsektenkunde. I, pp. 506–516, figs. 167–169. 1895.

### ***Tomicus (Myelophilus) piniperda** Linnæus.

(The large or black pine pith borer or "forest gardener." Scolytidæ; Coleoptera.)

*Hosts:* Pine.

*Injury:* Tunnels under bark of trunk and branches. Young adults feed on pith of 1 to 2-year old shoots. Attack sickly and quite healthy trees and invariably cause their death from above downward. Attacks thin, smooth bark of trunk and branches and heavy barked portion of lower trunk of living felled or sickly trees.

*Description:* Beetle elongate, 3.5–4.5 mm. long; proboscis finely and not densely punctate; elytra finely punctate-striate, posteriorly with a row of brush-bearing small tubercles.

*Evidence of infestation:* Fading and dying tops; long vertical galleries in bark. Twigs hollow at tip with pitch tubes at base.

*Distribution:* Europe.

Nüsslin, O. Leitfaden der Forstinsektenkunde. 1913, pp. 243–246, figs. 207–210.

Judeich, J. F., und Nitsche, H. Lehrbuch der Mitteleuropäischen Forstinsektenkunde. pp. 462–472, figs. 145 and 146, 1895.

### **Bupalus piniarius** Linnæus.

(Pine Geometrid. Geometridæ; Lepidoptera.)

*Hosts:* Pine, spruce, fir.

*Injury:* Feeds on foliage and young shoots.

*Description and biology:* Male moth bright yellow, female bright reddish brown, both marked with dark brown. Larva green, with three white dorsal lines and two yellow lateral lines.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 337.

Nüsslin, Otto. Leitfaden der Forstinsektenkunde 2d ed., 1913, pp. 385–390, figs. 315–317.

### **Dasychira selenitica** Esp.

(Larch Tussock Moth. Lymantriidæ; Lepidoptera.)

*Hosts:* Larch, pine, sainfoin, herbs, hardwoods.

*Injury:* Defoliator, especially injurious to young trees.

*Description and biology: Moth* brown; male olive brown; female brownish black, with white crescent and wavy line on wings. *Larva* black, with dark-gray hairs on black warts, and the fourth to eighth segments each with a yellowish gray brush of hairs tipped with black; first segment with black hair pencil, eleventh segment with two. Pupates on surface of ground in a cocoon.

*Distribution:* Germany.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 384.
Nüsslin, Otto. Leitfaden der Forstinsektenkunde, 1913, 2d ed., p. 376.

### Laspeyresia duplicana Zetterstedt.

(Fir Bark Tortricid. Tortricidæ; Lepidoptera.)

*Hosts:* White fir (*Abies pectinata*), juniper (*Juniperus*), spruce (*Picea excelsa*).

*Injury:* Breeds in the bark and possibly sometimes the twigs.

*Description and biology: Moth* 15–16 mm. in wing expanse; forewings dark brown, with a white crescentiform spot at middle and finer markings beyond. The larva breeds from fall to spring under bark. Its life history is not definitely worked out.

*Distribution:* Europe (Germany).

Nüsslin, Otto. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 411, 412, fig. 343.
Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 281.
Hess, Richard. Der Forstschutz, 1898, vol. 1, pp. 485, 486, fig. 173.

### *Enarmonia pinicolana Zell.

(Gray Larch Moth. Tortricidæ; Lepidoptera.)

*Hosts: Larix, Abies*, Siberian stone pine (*Pinus cembra* L.).

*Injury:* Attacks the needles.

*Description and biology: Moth*, wing expanse 18–22 mm., forewings shining light gray with brown markings. *Larva* dark green with darker stripes, head and thoracic shield black. Feeds under webs on the needles.

*Distribution:* Europe, Siberia, North America, but serious only in Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, v. 3, p. 286.
Nüsslin, Otto. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 419–422, figs. 354–355.

## B. OTHER GENERAL CONIFEROUS PESTS.

### HEMIPTERA.

**Aphididæ.**

**Mindarus abietinus* Koch, a plant louse; Europe; attacks young shoots of *Abies pectinata* and bark of *Picea*.

**Phylloxeridæ.**

*Pineus sibiricus* Cholodkovsky; a gall louse; Russia; attacks *Pinus cembra* and *Picea* in alternating generations.
*Pineus orientalis* Dreyfus and *P. pini* Koch; Europe; attack *Picea orientalis, P. excelsa, Pinus montana, P. silvestris*, and *P. strobus*, its generations alternating on pine and fir.
*Pineus strobi* Hartig, gall louse; Europe; attacks *Pinus strobus*.
*Aphrastasia pectinatæ* Cholodkovsky; gall louse; northeast Europe; attacks *Abies* and *Picea*.
*Dreyfusia nuesslini* C. B.; gall louse; Europe; attacks *Abies nordmanniana* and *Picea*.
**Dreyfusia piceæ* Ratzeburg; gall louse; Europe; attacks stems of *Abies pectinata*.
*Chermes viridis* Ratzeburg, a gall louse; Europe; attacks *Larix* and *Picea*.
**Chermes abietis* Kaltenbach, a gall louse; Europe; attacks *Larix, Abies pectinata, Pinus cembra, P. silvestris*.
*Cnaphalodes strobilobius* Kaltenbach; gall louse; Europe; attacks *Larix* and *Abies*.
*Cnaphalodes lapponicus* Cholodkovsky; Europe; attacks *Picea* and *Larix*.

### COLEOPTERA.

**Melandryidæ.**

**Serropalpus barbatus* Schall.; Europe; bores in the bark and wood of *Abies pectinata* and *Picea*.

**Bostrychidæ.**

*Apate molle* Linnæus; Europe; bores in bark-stripped wood of conifers.

**Buprestidæ.**

*Anthaxia quadripunctata* Linnæus; Germany; bores in stems of young trees and branches of older trees of spruce (*Picea*).

**Elateridæ.**

*Agriotes aterrimus* Linnæus, *A. lineatus* Linnæus, and *A. obscurus* Linnæus; Europe; attack the seedlings and roots of pine, fir, and spruce, while some species attack larch.

*Dolopius marginatus* Linnæus; Europe; attacks the roots of seedling and yearling fir, pine, and spruce.

*Selatosomus æneus* Linnæus; Europe; attacks roots of pine, fir, and spruce.

**Tenebrionidæ.**

*Setenis semiopaca* Blair; India; breeds in the trunks of *Picea morinda* and *Pinus excelsa*.

**Cerambycidæ.**

* *Hylotrupes bajulus* Linnæus; Europe; bores in the finished lumber, especially building timbers and furniture of coniferæ.

*Monohammus sartor* Fabricius and *sutor* Linnæus; Europe; attack bark and wood of fir and spruce.

*Pogonochærus fasciculatus* De Geer; Europe (Germany); bores in the wood of spruce, pine, and fir.

*Tetropium castaneum* Linnæus; Europe; bores in the wood of larch, spruce, pine, and fir.

**Brachyrhinidæ (Otiorhynchidæ).**

*Metallites atomarius* Olivier, *M. laricis* Chevrolat, *M. mollis* Germar; weevils; Europe; as adults injure the buds of conifers; the larvæ breed at the roots of trees.

*Brachyxystus subsignatus* Faust; a weevil; India; adult causes very serious defoliation of *Abies webbiana* and *Picea morinda*.

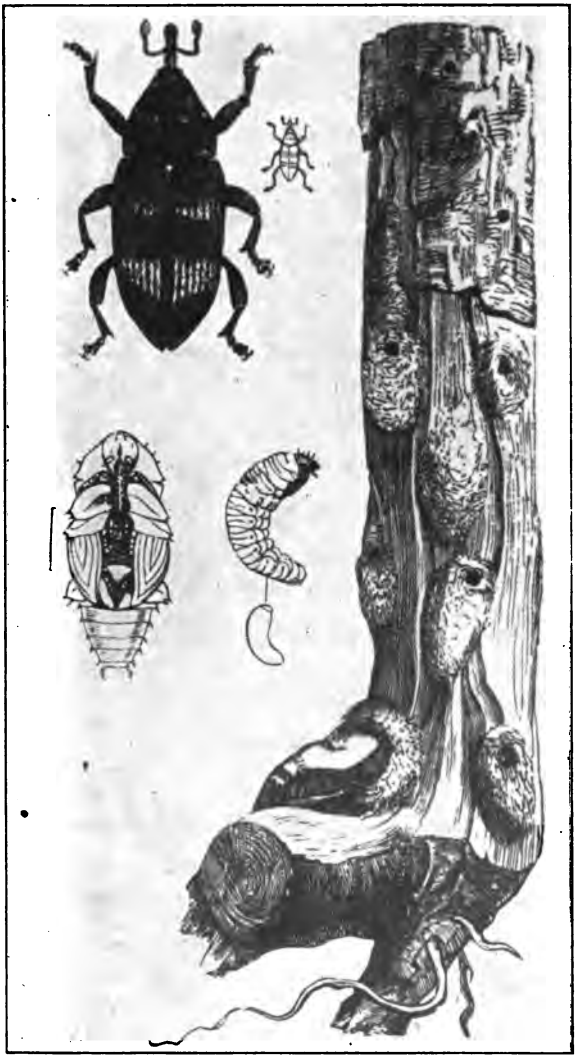


FIG. 36.—Coniferous bark weevil (*Pissodes notatus*): *Adult*, larva, pupa, injury. (Henschel.)

**Curculionidæ.**

*Hylobius abietis* Linnæus, *H. fatuus* Rossi, and *H. piceus* De Geer; Europe; breed in the bark and wood of conifers. These are very important weevils.

*Pissodes harcyniæ* Herbst, *P. notatus* Fabricius, *P. piceæ* Illiger, *P. pini* Linnæus, and *P. piniphilus* Herbst; weevils; Europe; breed under bark of pines, spruce, and fir. (See text fig. 36.)

**Cossonidæ.**

*Rhyncolus ater* Linnæus, *R. elongatus*, *R. porcatus* Germar, *R. lignyarius* Marsh., *R. strangulatus* Perris, *R. truncorum* Germar, and *R. cylindricus* Boheman; Europe; bore in the trunks and rotten wood of pines, spruce, and fir.

*Rhyncolus himalayensis* Stebbing; India; bores in the wood of *Pinus excelsa* and *Picea morinda*.

**Ipidæ.**

*Cryphalus abietis* Ratzeburg; Europe; attacks fir (*Abies pectinata*), spruce (*Picea excelsa*), and pine.

*Cryphalus saltuarius* Weiss; Europe; attacks young fir, spruce, and pine.

*Cryphalus boswelliæ* Stebbing; India; attacks spruce and *Pinus longifolia*.

*Cryphalus piceæ* Ratzeburg; Europe; attacks *Abies pectinata* and larch.

*Crypturgus pusillus* Gyllenhal; Germany; attacks spruce, fir, pine (*Pinus strobus* and *P. pinaster*). and larch. In the Himalayas this species attacks *Pinus excelsa* and *Picea morinda*.

*Dryocoetes autographus* Ratzeburg; Germany; attacks spruce, fir, and pine (*Pinus strobus*).

*Hylastes attenuatus* Erichson; Germany; attacks pine and spruce.

*Hylastes decumanus* Erichson; Europe; attacks spruce and *Pinus cembra*.

*Hylastes himalayensis* Stebbing; India; attacks *Picea excelsa*.

*Hylurgops palliatus* Gyllenhal; Europe; attacks *Pinus silvestris, P. strobus, P. pinea, P. austriaca P. maritima*, larch, and spruce.

*Ips amitinus* Eichoff; Europe; attacks spruce, pine, fir, and larch.

*Ips cembræ* Heer; Europe; attacks larch and *Pinus cembra*.

*Ips duplicatus* Sahlberg; Finland and Ural; spruce and pine.

*Ips sexdentatus* Boerner; Europe; spruce and pine (*Pinus austriaca* and *P. pinaster*).

*Ips ribbentropi* Stebbing; India; *Pinus excelsa* and *Picea morinda*.

* *Ips typographus* Linnæus; Europe; attacks spruce, larch, Scotch fir (*Pinus silvestris*).

*Tomicus* (*Myelophilus*) *minor* Hartig; Europe; attacks pine and spruce.

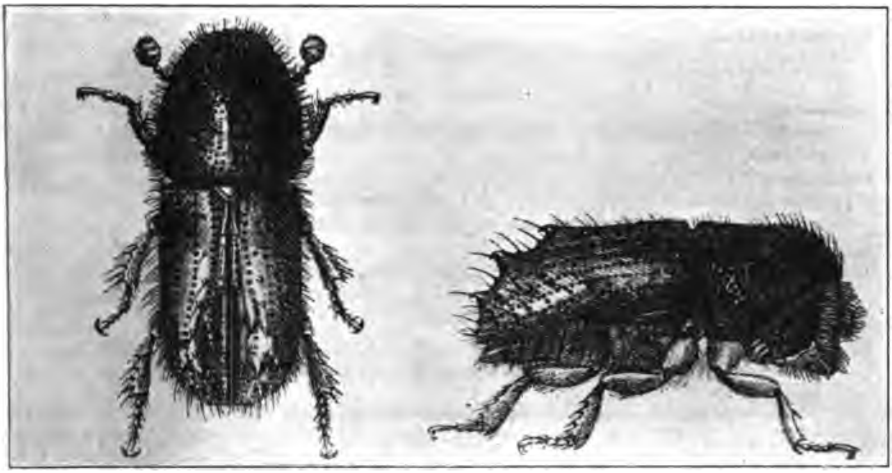


FIG. 37.—Barkbeetle (*Pityogenes chalcographus*). (Eckstein.)

* *Tomicus* (*Myelophilus*) *piniperda* Linnæus; Europe to Japan; pines, larch, spruce.

*Orthotomicus suturalis* Gyllenhal; Europe; spruce, fir (*Picea excelsa*), pine (*Pinus austriaca* and *P. silvestris*).

*Orthotomicus laricis* Fabricius; Europe; attacks fir (*Abies pectinata*), larch, spruce, pine (*Pinus silvestris*).

*Orthotomicus proximus* Eichoff; Europe; thin bark of upper stems of pine and spruce.

*Pityogenes bidentatus* Herbst; Europe; larch, spruce, and pine (*Pinus austriaca, P. strobus, P. pinaster, P. silvestris*).

*Pityogenes bistridentatus* Eichoff; Germany, France; pine, fir.

*Pityogenes chalcographus* Linnæus; fir (*Abies pectinata*), spruce (*Picea excelsa*), pine (*Pinus strobus*), larch. (See text fig. 37.)

*Pityogenes coniferæ* Stebbing; India; blue pine (*Pinus excelsa*), Chilgoza pine (*P. gerardiana*), fir (*Picea morinda*). (See plate XI, fig. 3*a-c*.)

*Pityogenes pilidens* Reitter; Europe and Asia Minor; *Pinus austriaca* and fir.

*Pityogenes quadridens* Hartig; Europe; *Pinus silvestris* and Siberian spruce.

*Pityokteines curvidens* Germar; Europe; spruce (*Picea excelsa*), larch, balsam fir (*Abies balsamea*), pine (*Pinus silvestris*).

*Pityophthorus micrographus* Linnæus; Europe; attacks *Abies pectinata, Pseudotsuga mucronata, Picea excelsa, Pinus strobus*.

*Polygraphus major* Stebbing; India; *Pinus excelsa, Picea morinda*

*Polygraphus pini* Stebbing; India; *Pinus excelsa, Picea morinda*

*Polygraphus polygraphus* Linnæus; Europe; spruce, fir, pine (*Pinus silvestris, P. strobus*).

**Ipidæ**—Continued.

*Polygraphus subopacus* Thomson; Europe; spruce, pine.
*Xylechinus pilosus* Knoch; Europe; pine, spruce, larch
*Xyloterus lineatus* Olivier; Europe; fir, spruce, pine, larch.

### LEPIDOPTERA.

**Lymantriidæ.**

**Lymantria monacha* Linnæus; Europe; defoliator on pine, spruce, larch. (See Forests.)
*Orgyia antiqua* Linnæus; Europe; spruce, pine; defoliator.

**Noctuidæ.**

*Agrotis segetum* Schiffermiller; Europe; injures roots of seedlings and nursery stock of spruce, larch, pine.
*Agrotis vestigialis* Rott.; Europe; injures roots of seedlings and nursery stock of pine and larch.

**Pyralidæ.**

*Euzophera cedrella* and *Phycita abietella;* India; infest cones of blue pine (*Pinus excelsa*), fir (*Picea morinda*), and silver fir (*Abies webbiana*).

**Tortricidæ.**

*Asthenia pygmæana* Hübner; Europe; spruce, fir; attacks needles on young shoots.
*Tortrix piceana* Linnæus; Europe; attacks foliage of pine and other conifers.
*Enarmonia pinicolana* Zell; Europe; attacks foliage of larch, pine, and spruce.
*Tortrix viburniana* Fabricius; Norway; attacks *Picea excelsa*, *Pinus silvestris*, *P. montana*, *Larix decidua.*

**Hyponomeutidæ.**

*Argyresthia fundella* F. R.; Europe; attacks needles of fir, spruce, and pine.

### HYMENOPTERA.

**Callimonidæ.**

*Megastigmus strobilobius* Ratzeburg; a chalcid; Europe; breeds in seed of hemlock and fir (*Abies pectinata*).

**Diprionidæ.**

*Diprion pini* Linnæus; *D. rufus* Klug, and *D. pallidus* Klug; Europe; attack bark and needles
**Diprion simile;* Europe, Connecticut. An important sawfly, recently imported.

**Megalodontidæ.**

*Acantholyda erythrocephala* Linnæus; sawfly; Germany; attacks foliage of pine, larch, spruce, fir.
*Cephaleia hypotrophica* Hartig, and *C. signata* Fabricius; Europe; attack foliage of pine, spruce, fir.
*Itycorsia stellata* Christ.; sawfly; Europe; pine and fir.

**Siricidæ.**

*Sirex juvencus* Linnæus, *S. spectrum* Linnæus, and *S. gigas* Linnæus; wood wasps; Europe; bore in wood of spruce, fir, pine, and larch.
*Xeris spectrum* Linnæus; wood wasp; Europe; bores in spruce and fir wood.

### DIPTERA.

**Tipulidæ.**

*Pachyrhina crocata* Linnæus; crane fly; Germany; breeds in bark of young seedling balsam fir (*Abies balsamea*) and larch.

## C. BETTER KNOWN IMPORTANT PESTS OF PINE (PINUS).

### **Eriophyes pini** Nalepa.

(Pine Gall Mite. Eriophyidæ; Acarina.)

*Hosts: Pinus silvestris*, *P. montana*, *P. mughus.*

*Injury:* Causes galls in the twigs resulting in deformed growth.

*Description and biology:* A tiny elongate four-legged mite which breeds in the young twigs of pines.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 116, 117, figs. 90–92.

### **Gelechia dodecella** Linnæus.

(Pine Bud Moth. Gelechiidæ; Lepidoptera.)

*Hosts:* Pines (*Pinus* spp.).

*Injury:* Breeds in buds, needles, and young shoots, and is as injurious as *Evetria buoliana*, the pine-shoot moth.

*Description and biology: Adult* moth with wing spread 10–12 mm., forewings dark gray or gray brown, with two obscure light gray transverse fasciæ, and six pairs of black flecks. *Larva* reddish brown with black head and thoracic shield. The larva bores in buds, needles, and young shoots.

*Distribution:* Germany.

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913, p. 430, fig. 365.

### **Cnethocampa pinivora** Treitschke; **Cnethocampa pityocampa** Schiffermiller.

(Pine Procession Moths. Cnethocampidæ; Lepidoptera.)

*Hosts:* Pines.

*Injury:* Defoliate; sometimes serious.

*Description and biology: Moth* of *pinivora* with forewings yellowish gray, hind wings with a sharply toothed crossline. *Moth* of *pityocampa* with forewings whitish gray; hind wings with a scarcely toothed crossline. *Larva* of *pinivora* greenish gray, with velvety black dorsal stripe and black head, and with reddish yellow warts on the fourth to eleventh segments. *Larva* of *pityocampa* similar but slate blue to black. The larvæ feed on the foliage and live gregariously, wandering in the daytime in processions of a single or double row. Pupate in cocoons in the ground. The larvæ of *pityocampa* hibernate in nests in the crowns.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 386.
HESS, RICHARD. Der Forstschutz, 1900, vol. 2, pp. 452–455.
NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913.

### **Dendrolimus pini** Linnæus.

(Pine Spinner. Lasiocampidæ; Lepidoptera.)

*Hosts:* Pine.

*Injury:* Very serious defoliator.

*Description and biology: Moth* variable in color, from brown red to slate gray, unicolorous or mottled; middle of forewings with white crescent. *Larva* 8 cm. long, with steel-blue stripes on meso- and metathorax, general color varying from reddish to slaty gray; pubescence very long and clustered. The larva feeds on the foliage and spins a neat oval silken cocoon.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 376.
NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 331–342, figs. 284, 285.

### **Panolis griseovariegata** Goeze.

(Pine Noctuid. Noctuidæ; Lepidoptera.)

*Hosts:* Pine.

*Injury:* Attacks foliage, buds, and tender shoots.

*Description and biology: Moth* with forewings variegated cinnamon red and yellowish gray with white marks; hind wings brownish black. *Larva* green, with three broad white dorsal stripes, a yellowish orange lateral stripe, head shining yellowish, 35 mm. long. *Eggs* greenish, laid in a row on the underside of needles.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 357.
NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 378–380, figs. 308, 309.

### * **Evetria buoliana** Schiffermiller.

(European Pine-Shoot Moth. Tortricidæ; Lepidoptera.)

*Hosts: Pinus silvestris, P. laricio, P. montana, P. strobus, P. resinosa.*

*Injury:* Causes deformation of tree. Has been introduced into the United States in nursery shipments.

*Description and biology: Adult* moth 12 mm. long, small, gayly colored; the head and its appendages and thorax light orange yellow, abdomen dark gray; forewings bright ferruginous orange, suffused with dark red, especially toward the tips, and with several irregular forked anastomizing, silvery crosslines and costal strigulæ; hind wings dark blackish brown; legs whitish, the anterior ones reddish in front. *Pupa* stout, robust, chestnut brown; abdominal segments with rings of short dark spines. *Larva* 16 mm. long, brown with black head and thoracic shield; feeds in the young buds and sheets. *Egg* small, flat, white, laid at base of bud. (See plates XII, XIII.)

*Distribution:* Europe, introduced into United States in 32 nurseries.

BUSCK, A. U. S. Dept. Agric., Bul. 170, Feb., 1915.

### * **Evetria** spp.

(Pine Bud and Gall Moths. Tortricidæ; Lepidoptera.)

*Species:* In addition to * *E. buoliana* Schiffermiller which is separately treated, the following species injure pines. *E. resinella* Linnæus; Europe; makes large galls in twigs of pines. * *E. turionana* Hübner; Europe, North America; attacks buds of pines, especially the terminal bud. * *E. pinivorana* Zeller; Europe, North America; attacks the axillary buds. * *E. duplana* Hübner, Europe, Japan, North America; attacks young shoots. * *E. frustrana* Comstock, the Nantucket pine moth, * *E. rigidana* Fernald, and * *E. comstockiana* Fernald are among our most serious pests in this country.

*Distribution:* The distribution cited above shows clearly that these species are readily distributed in nursery stock.

SORAUER, B. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 290–292.

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 415–419, figs. 347–351.

### **Thecodiplosis brachyntera** Schwäger.

(Pine Needle Midge. Itonididæ [Cecidomyidæ]; Diptera.)

*Hosts: Pinus silvestris, P. laricio, P. montana.*

*Injury:* Breeds in the needles, forming a small gall-like swelling.

*Description and injury: Fly* very small. *Larva* yellowish. Egg laid between the bases of two needles.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 444.

## D. OTHER INSECTS ATTACKING PINE (PINUS).

### HEMIPTERA.

**Aphididæ:**

*Lachnus pini* Linnæus *L. tomentosus* DeGeer, *L. tæniatus* Koch, *L. nudus* DeGeer, and *L. agilis* Kaltenbach, plant lice; Europe; attack needles, tender growth and twigs.

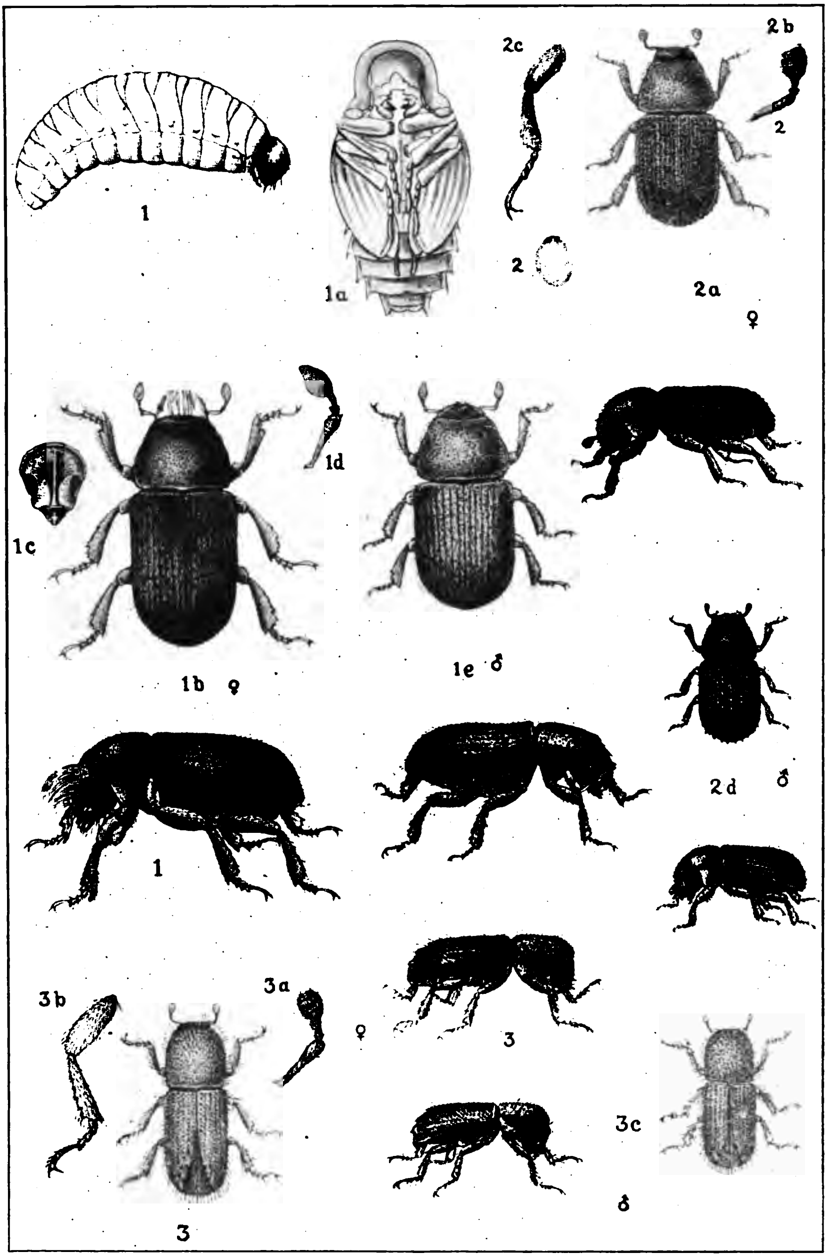
**Coccidæ:**

Armored—

*Aspidiotus (Aonidia) lauri* Bouché; Italy; *Pinus.*

*Aspidiotus (Aonidia) pinicola* Leonardi; Cyprus, Spain; *Pinus halepensis, P. silvestris.*

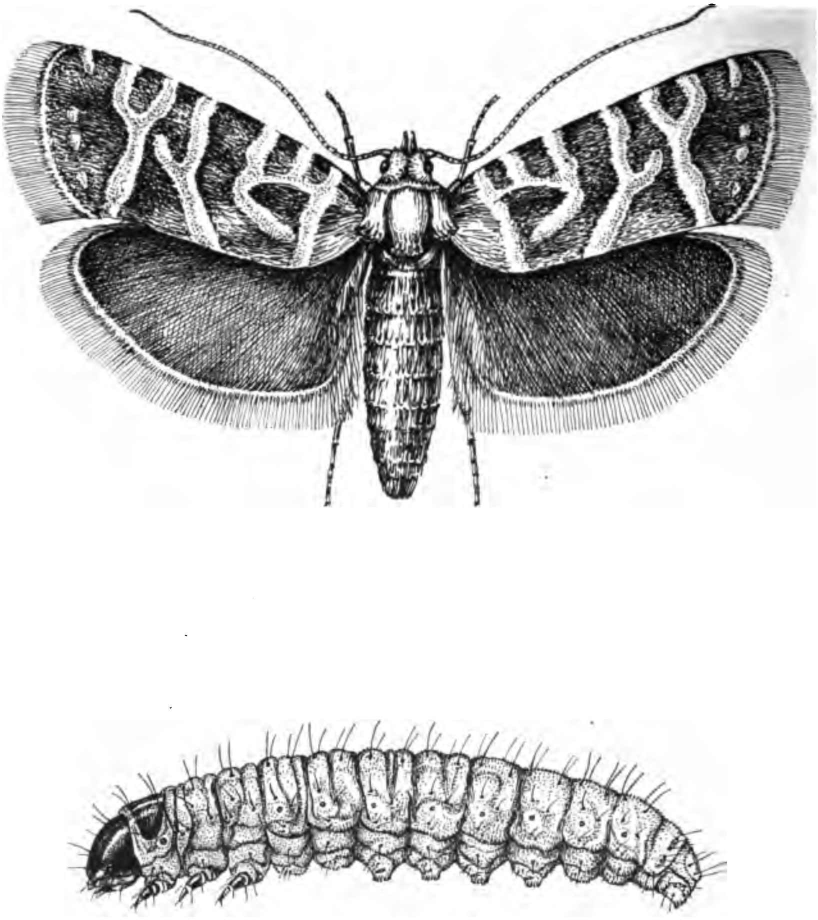
*Chionaspis austriaca* Lindinger; Australia; *Pinus laricio nigricans.*



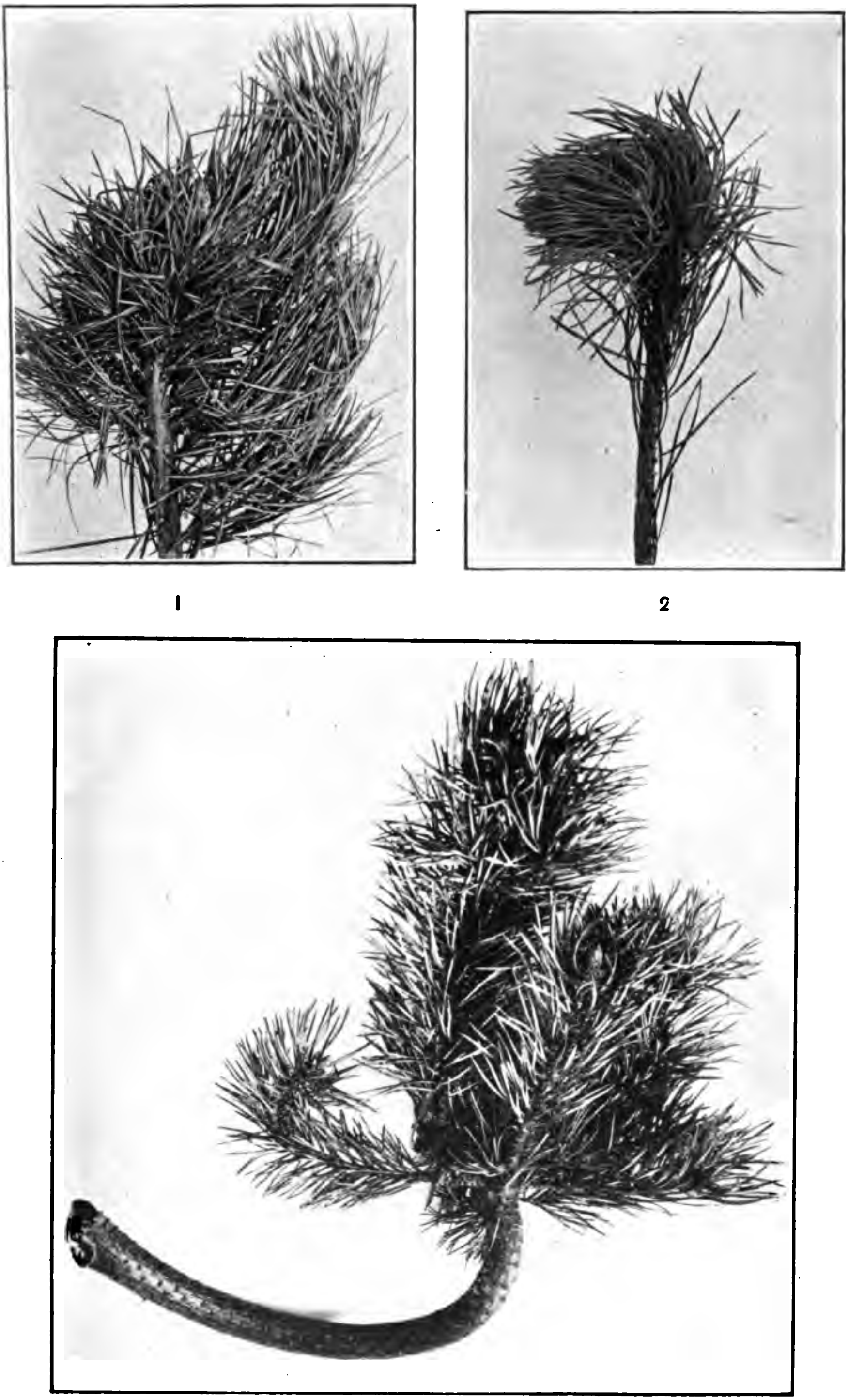
CONIFEROUS BARK BEETLES.

FIG. 1.—*Polygraphus trenchi:* Larva; *1a*, pupa; *1b*, adult female, dorsal view (above) and lateral view (below); 1c, head of female; *1d*, antenna; *1e*, adult male, dorsal view (above) and lateral view (below). FIG. 2.—*Phloeosinus zhobi:* Egg; *2a*, adult female, dorsal view (above) and lateral view (below); *2b*, antenna; *2c*, leg; *2d*, adult male, dorsal view (above) and lateral view (below). FIG. 3.—*Pityogenes coniferae:* Adult female, dorsal view (left) and lateral view (right, above figure); *3a*, antenna; *3b*, leg; *3c*, adult male, lateral view (left) and dorsal view (right). (Stebbing.)

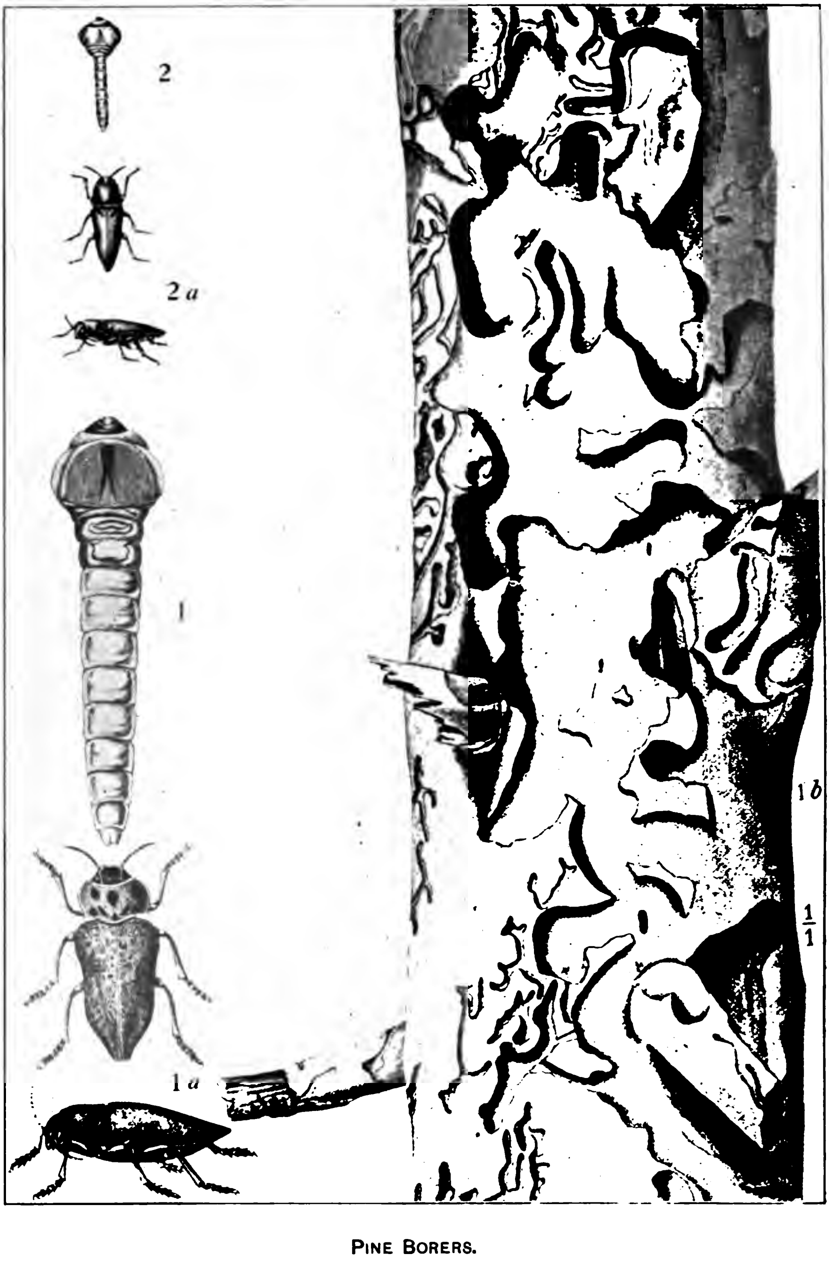
UNIV. OF



European Pine Shoot Moth, Evetria buoliana, Moth, Larva. (Busck.)

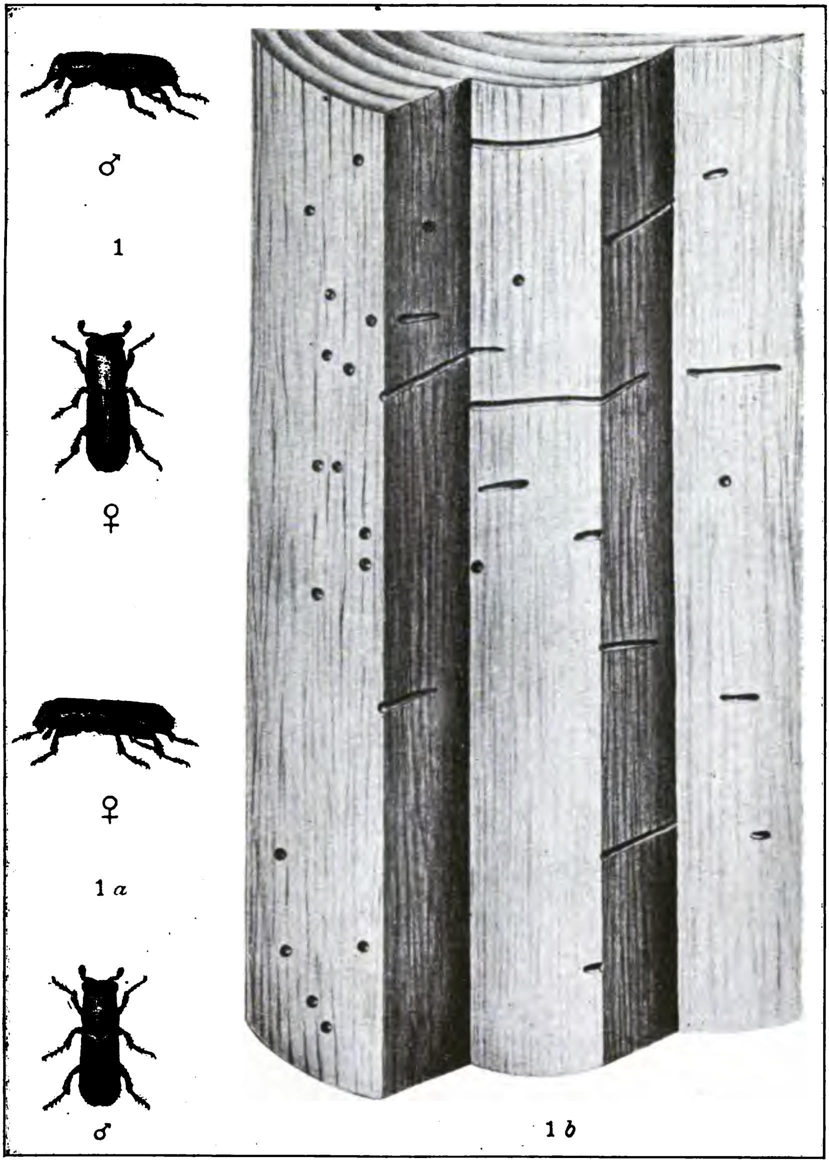


WORK OF EVETRIA BUOLIANA ON PINE SHOOTS. (BUSCK.)



PINE BORERS.

FIG. 1.—*Capnodis indica:* Larva; 1*a*, adults. FIG. 2.—*Anthaxia osmastoni:* Larva; 2*a*, adults. FIG. 1*b*.—Stem of *Pinus longifolia* showing work of both beetles. (Stebbing.)



THE PINE BARK BEETLE.

**The pine bark beetle (*Platypus biformis*): Males and females and injury to *Pinus longifolia*. (Stebbing.)**

**Coccidæ**—Continued.
Armored—Continued.
*Diaspis visci* Schrank; Germany, Italy; *Pinus filifolia, P. silvestris.*
✱*Lepidosaphes newsteadi* Sulc; Europe; *Pinus austriaca, P. pumilio, P. silvestris.*
*Leucaspis lœwi* Colvée; Europe; *Pinus* spp.
*Leucaspis pini* Hartig; Europe; *Pinus austriaca.*
*Leucaspis pusilla* Lœw; Europe; *Pinus cembra, P. silvestris.*
*Leucaspis signoreti* Targioni-Tozzetti; Italy, Corsica, Cyprus; *Pinus halepensis, P. laricio; P. silvestris.*
*Poliaspis pini* Maskell; Japan; *Pinus densiflora, P. austriaca, P. thunbergii.*
Unarmored—
*Gueriniella serratulæ* Fabricius; Algeria; southern France; *Pinus.*
*Palæococcus fuscipennis* Burmeister; Germany, France; *Pinus silvestris.*
*Pseudococcus pini* Kuwana; Japan; *Pinus.*
*Puto antennata* Signoret; France, Switzerland; *Pinus cembra, P. silvestris.*

**Aradidæ;**
*Aradus cinnamomeus* Panzer; Europe; occurs under bark scales; causes needles to become yellow and remain small.

## COLEOPTERA.

**Anobiidæ;**
*Ernobius abietinus* Gyllenhal; Europe; attacks cones.
*Ernobius nigrinus* Sturm, and *E. pini* Sturm; Europe; attacks pith of young shoots.
*Xestobium plumbeum* Illiger; Europe; breeds in the dead wood.

**Meloidæ;**
*Cantharis fusca* Linnæus; a blister beetle; Europe; attacks shoots.

**Buprestidæ.**
*Agrilus betuleti* Ratzeburg; and ✱*A. viridis* Linnæus; Germany; bore stems of young trees and branches of older trees.
*Chrysobothris solieri* Laporte et Gory; Europe; bores in bast and sapwood of seedlings of *P. silvestris* and *P. pinaster.*
*Capnodis indica* Thomson; India; bores in bast and sapwood of *Pinus longifolia.* (See. pl. XIV, figs. 1*a*, 1*b*.
*Buprestis geometrica* Laporte et Gory; India; bores in *Pinus longifolia.*
*Anthaxia osmastoni* Stebbing; India; bores in the bark and bast of *Pinus longifolia.* (See pl. XIV, fig. 2.)
*Phænops cyanea* Fabricius; Europe; bores in bark.

**Tenebrionidæ.**
*Melanimon tibiale* Fabricius, *Gonocephalum* (*Opatrum*) *sabulosum* Linnæus, and *Phylan gibbus* Fabricius attack tender roots, bark, and tops of seedlings and nursery stock.
*Setenis indosinica* Fairmaire; India; bores in wood of *Pinus excelsa.*
*Blaps armata* Blair; India; bores in the trunks of *Pinus gerardiana.*

**Scarabæidæ.**
*Amphimallon solstitialis* Linnæus; England; injures the roots of *Pinus silvestris.*
*Melolontha hippocastani* Fabricius; *M. melolontha* Linnæus; Europe; injure roots of seedling and needles.
*Polyphylla fullo* Linnæus; Europe; attacks the roots of seedlings, and the adults feed on the needles.

**Cerambycidæ.**
*Acanthocinus ædilis* Linnæus; Germany; bores in the sapwood of felled or prepared lumber.
*Monohammus galloprovincialis* Olivier; Germany; attacks *Pinus silvestris* and *P. pinaster.*
*Nothorhina muricata* Dalman, India; bores in trunks of *Pinus longifolia.*
*Criocephalus tibetanus* (?) Sharp; India; bores in bast and sapwood of *Pinus gerardiana.*

**Chrysomelidæ.**
*Cryptocephalus pini* Linnæus; Germany; attacks the foliage and bark of young shoots.
*Luperus pinicola* Duftschmidt; Germany; attack the foliage and bark of young shoots.

**Brentidæ.**
*Eubactrus* sp.; India; bores in trunks of *Pinus longifolia.*

**Rhinomaceridæ.**
*Rhinomacer attelaboides* Fabricius; a weevil; Germany; breeds in the catkins.

**Brachyrhinidæ.**
*Polydrusus chærodrysius* Gredler, *P. intermedius* Zetterstedt, *P. undatus* Fabricius, *P. villosulus* Chevrolat; Europe; attack the buds and needles of conifers; the larvæ breed at the roots of trees.

**Curculionidæ.**

*Brachonyx pineti* Paykull; weevil; Europe; mines the needles of *Pinus silvestris*.

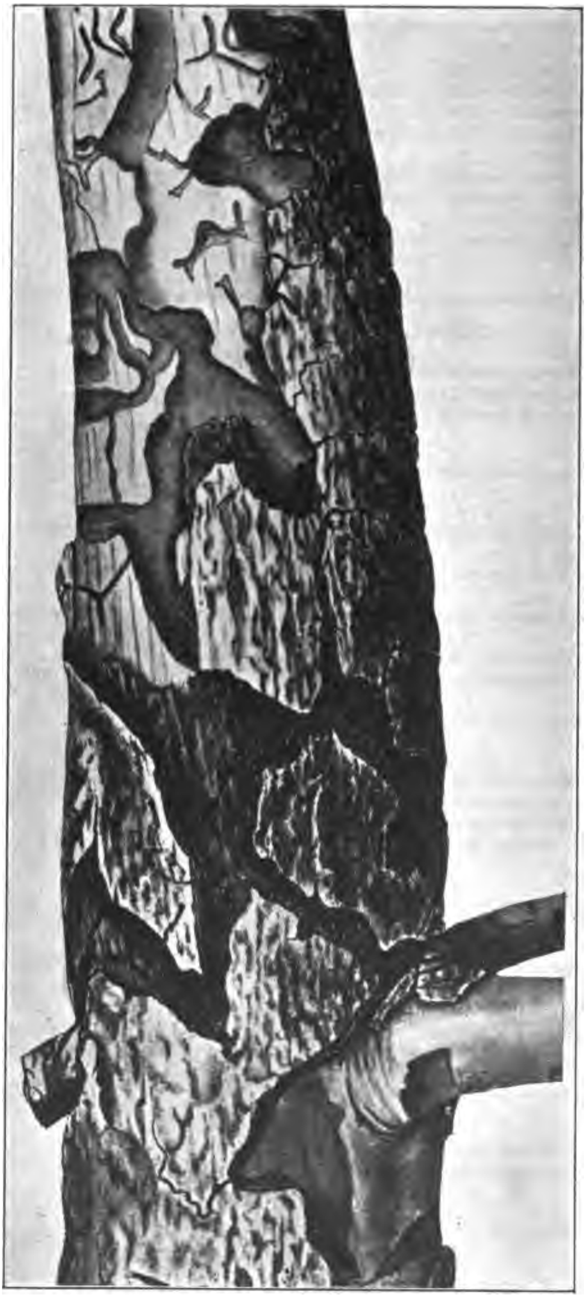


FIG. 38.—Pine weevil (*Cryptorhynchus brandisi*): Injury to *Pinus longifolia*. (Stebbing.)

*Cryptorhynchus brandisi* Stebbing, the chir pine weevil; India; breeds in wood of *Pinus longifolia* and *P. khasya*. (See text fig. 38.)

*Cryptorhynchus raja* Stebbing; India; breeds in bark and sapwood of *Pinus excelsa*.

**Cossonidæ.**

*Mesites aquitanus* Fairmaire; Europe; bores in pine wood standing in sea water.

**Ipidæ.**

*Carphoborus minimus* Fabricius; Germany; makes galleries in branches and tops of *Pinus austriaca*, *P. montana*, and *P. silvestris*.

*Cryphalus longifolia* Stebbing; India; *Pinus longifolia*.

*Cryphalus major* Stebbing; India; *Pinus longifolia*.

*Crypturgus cinereus* Herbst; Germany.

*Hylastes angustatus* Herbst, *H. ater*, and *H. opacus* Erichson, attack taproots.

*Hylastes longifolia* Stebbing; India; *Pinus longifolia*.

*Hylurgus ligniperda* Fabricius; Germany; attacks taproots.

*Ips blandfordi* Stebbing; India; *Pinus gerardiana*.

*Ips acuminatus* Gyllenhal; Lapland to Sicily; bark and sapwood.

*Ips longifolia* Stebbing; India, *Pinus longifolia* and *P. gerardiana*.

*Ips mannsfeldi* Wachtl.; Europe; *Pinus austriaca*.

*Orthotomicus erosus* Wollaston and *O. longicollis* Gyllenhal; Europe.

*Phlœosinus zhobi* Stebbing; India; *Pinus gerardiana*. (See pl. XI, figs. 2*a*–2*d*.)

*Pityogenes trepanatus* Nordl.; Europe; *Pinus austriaca*.

*Pityogenes lipperti* Henschel; Dalmatia; Aleppo pine.

*Pityophthorus sampsoni* Stebbing; India; *Pinus excelsa*.

**Ipidæ**—Continued.

*Pityophthorus glabratus* Eichhoff; Europe; *Pinus silvestris.*
*Pityophthorus lichtensteini* Ratzeburg; Europe; *Pinus silvestris, P. strobus, P. pinaster.*
*Polygraphus grandiclava* Thomson; Europe; *Pinus strobus.*
*Polygraphus trenchi* Stebbing; India; *Pinus gerardiana.* (See text fig. 39, and pl. XI, figs. 1*a*–1*e*.)
*Polygraphus nigra* Stebbing; India; *Pinus excelsa.*
*Polygraphus himalayensis* Stebbing; India; *Pinus longifolia.*
*Polygraphus longifolia* Stebbing; India; *Pinus longifolia.*
*Xyleborus eurygraphus* Ratzeburg; Europe.

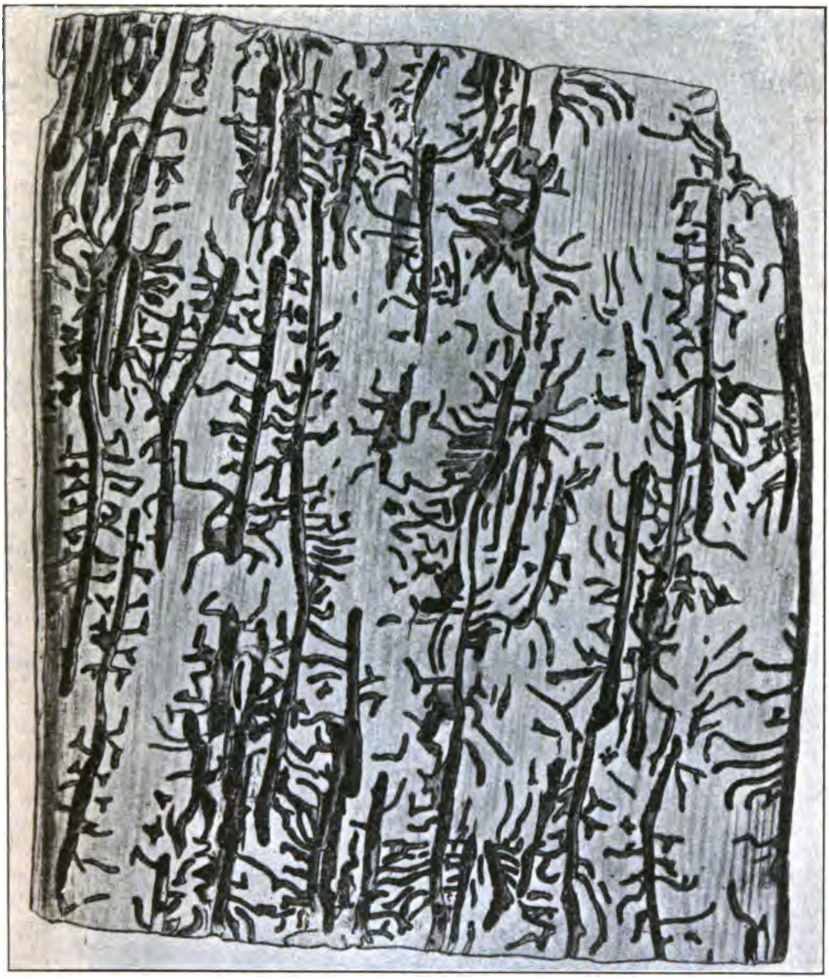


FIG. 39.—Pine bark beetle (*Polygraphus trenchi*): Galleries in *Pinus gerardiana.* (Stebbing.)

**Platypodidæ.**

*Crossotarsus fairmairei* Chapuis; India; bores in wood of *Pinus excelsa.*
*Platypus biformis* Chapuis; India; infests *Pinus longifolia.* (See pl. XV.)

## LEPIDOPTERA.

**Geometridæ.**

*Semiothisa liturata* Clm.; Europe; attacks the needles.

**Lasiocampidæ.**

*Lasiocampa quercus* Linnæus; Germany; attacks needles.

**Noctuidæ.**

*Agrotis tritici* Linnæus; Europe; injures roots of seedlings.

**Pyralidæ.**

*Dioryctria splendidella* H. Sch.; Germany; attacks cones, shoots, and sapwood.

*Ephestia elutella* Hübner; Germany; attacks seeds and cones.

**Psychidæ.**

*Clania crameri* Westwood; India; attacks needles of *Pinus longifolia*.

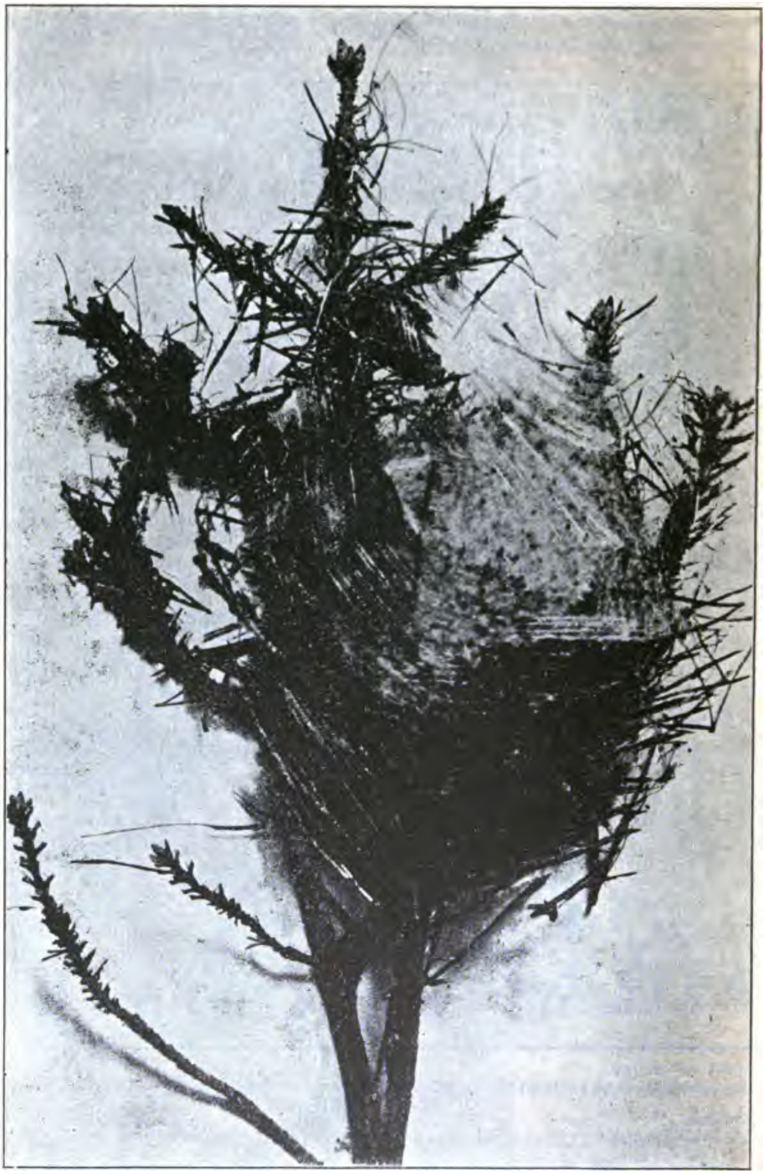


FIG. 40.—Pine web-worm (*Cncthocampa pityocampa*): Nests. (Barbey.)

**Hyponomeutidæ.**

*Ocnerostoma piniariella* Zell.; Germany; attacks needles.

**Cnethocampidæ.**

*Cnethocampa pinivora* Treitschke; Europe; attacks foliage.

*Cnethocampa pityocampa* Schiffermiller; Europe; attacks foliage of *Pinus pinea*, *P. pinaster*, *P. laricio*, *P. halepensis*. (See text fig. 40.)

### HYMENOPTERA.

**Megalodontidæ.**

*Itycorsia campestris* Linnæus, a sawfly; Europe; attacks needles. (See text fig. 41.)

## E. BETTER KNOWN IMPORTANT PESTS OF FIR (ABIES).

### Eucosoma nigricana H. Sch. (Epiblema).

(Fir Bud Worm. Tortricidæ; Lepidoptera.)

*Host:* Silver fir (*Abies pectinata* D. C.)

*Injury:* Feeds in the buds. Very likely to be introduced in buds on nursery stock during winter.

*Description and biology: Moth* wing expanse 11–13 mm., forewings dark brown with violet red shimmer and lead gray lines. *Larva* yellowish to reddish brown, with black head and thoracic shield. Feeds in the buds, hibernating as a larva. In the spring it goes from bud to bud, often under a silken web. Pupates in the ground.

*Distribution:* Europe (Germany).

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., pp. 408–409, fig. 340.

SORAUER, P. Handbuch der Pflanzenkrankheiten 3d ed., 1913, vol. 3, p. 285.

### Enarmonia rufimitrana H.-Schf. (Steganoptycha).

(Redheaded Fir Worm. Tortricidæ; Lepidoptera.)

*Hosts:* Silver fir (*Abies pectinata* D. C.).

*Injury:* Feeds on the needles and young shoots.

*Description and biology: Moth,* wing expanse 12–16 mm., head and thorax rust yellow, forewings yellowish gray with many lead-colored lines. *Larva* dirty yellow green, with rust-red head. (See text fig. 42.)

*Distribution:* Europe.

HESS, RICHARD. Der Forstschutz, 1898, vol. 1, p. 490, 491.

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913, p. 408, figs. 338,

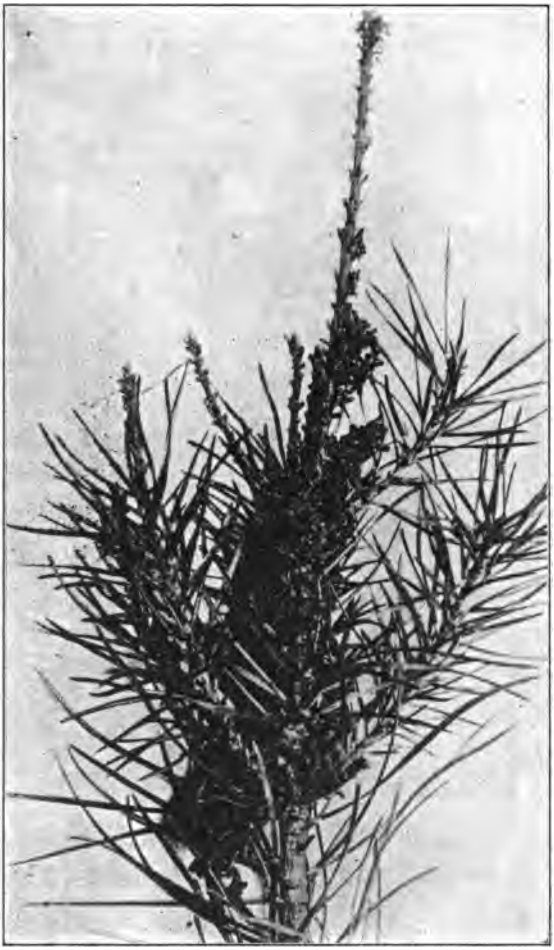


FIG. 41.—Pine sawfly (*Itycorsia campestris*): Injury. (Barbey.)

**Plemeliella abietina** Seitner.

(Spruce Seed Midge. Itonididæ [Cecidomyiidæ]; Diptera.)

*Host:* Fir (*Abies*).
*Injury:* Breeds in the seed, which become shrunken and worthless.
*Description:* Larvæ red.
*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 444.

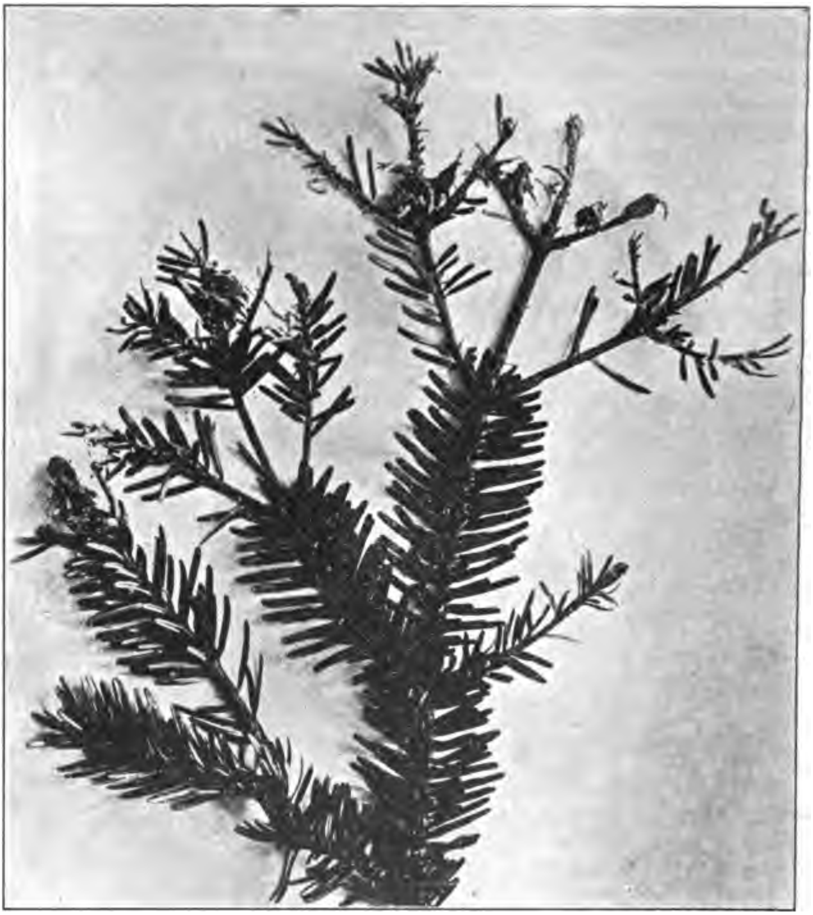


FIG. 42.—Red-headed firworm (*Enarmonia rufimitrana*): Injury. (Barbey.)

## F. OTHER INSECTS ATTACKING FIR (ABIES).

### HEMIPTERA.

**Aphididæ.**

*Lachnus grossus* Kaltenbach and *L. piceæ* Walker, plant lice; Europe (Germany); live on the bark.

*Lachnus pichtæ* Mordwilko; Europe; lives on the under side of the needles.

*Prociphilus bumeliæ* Schrank, a root louse; Europe; attacks roots of *Abies pectinata*, *A. balsamea*, and *A. fraseri*. (See Ash.)

**Coccidæ:**

Armored—

*Lepidosaphes abietis* Signoret; Europe; *Abies.*

*Poliaspis pini* Maskell; Japan; *Abies firma.*

Unarmored—

*Lecanium sericeum* Lindinger; Bavaria; *Abies pectinata.*

COLEOPTERA.

**Anobiidæ.**

*Dryophilus pusillus* Gyllenhal; Europe; attacks buds.

*Ernobius abietis* Fabricius, *E. angusticollis* Ratzeburg, and *E. longicornis* Sturm; Europe; attacks the cones.

**Lymexylonidæ.**

*Hylecœtus dermestoides* Linnæus; Germany; bores in white fir wood.

**Elateridæ.**

*Athous hirtus* Herbst; Europe; attacks seedlings of fir.

**Cerambycidæ.**

*Molorchus minor* Linnæus; Germany; attacks the sapwood of felled trees and lumber.

*Tetropium fuscum* Fabricius; Germany; bores in trunks of old and dead trees.

**Ipidæ.**

*Cryphalus strohmeyeri* Stebbing; India; *Abies webbiana.*

*Pityokteines spinidens* Reitter, and *P. vorontzowi* Jacobson; Europe.

*Xyloterus intermedius* Sampson; India; *Abies webbiana.*

**Scolytoplatypodidæ.**

*Scolytoplatypus himalayensis* Stebbing; India; *Abies webbiana.*

LEPIDOPTERA.

**Tortricidæ.**

*Tortrix murinana* Hübner; Europe; attacks needles and young shoots of *Abies pectinata.*

*Laspeyresia proximana* H. Sch.; Europe; mines the needles.

*Laspeyresia coniferana* Ratzeburg; Germany; bores in the bark of *Abies pectinata.*

*Olethreutes hercyniana* Treitschke; Europe; attacks needles of *Abies pectinata.*

HYMENOPTERA.

**Callimonidæ.**

*Megastigmus borriesi* Crosby; a chalcid; Japan; breeds in seed of *Abies mariesii.*

## G. BETTER KNOWN IMPORTANT PESTS OF SPRUCE (PICEA).

### Laspeyresia pactolana Zetterstedt (Grapholitha)

(Spruce Bark Tortricid. Tortricidæ; Lepidoptera.)

*Host:* Spruce (*Picea excelsa*).

*Injury:* Breeds in twigs, causing a swelling and deformation, or the death of the outer parts.

*Description and biology: Moth,* wing expanse 12–16 mm., forewing fringed, olive brown with double white angled fascia at the middle and several white marks beyond this; hind wings gray-brown, fringed. *Larva,* 10–12 mm. long, five pairs of abdominal legs, whitish to reddish in color, head and thoracic shield yellowish brown. (See text fig. 43.)

*Distribution:* Germany.

Hess, Richard. Der Forstschutz, 1898, vol. 1, pp. 483, 485, fig. 172.

Nüsslin, Otto. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 409–411, figs. 341, 342.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 281.

### Laspeyresia strobilella Linnæus (Grapholitha).

(Spruce Cone Moth. Tortricidæ, Lepidoptera.)

*Host.*—Spruce (*Picea excelsa*).

*Injury.*—Breeds in the cones.

*Description and biology.*—*Moth*, wing expanse 10–14 mm., forewings dark gray brown, fringed, with fine whitish lines, hind wings gray brown, with white fringe. *Pupates* in the cones. *Larva* 11 mm. long, yellowish white with light brown head and thoracic shield. The larva breeds in the cones. *Eggs* laid on the young green cones.

*Distribution:* Germany.

Hess, Richard. Der Forstschutz, 1898, vol. 1, pp. 486, 487.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 281.

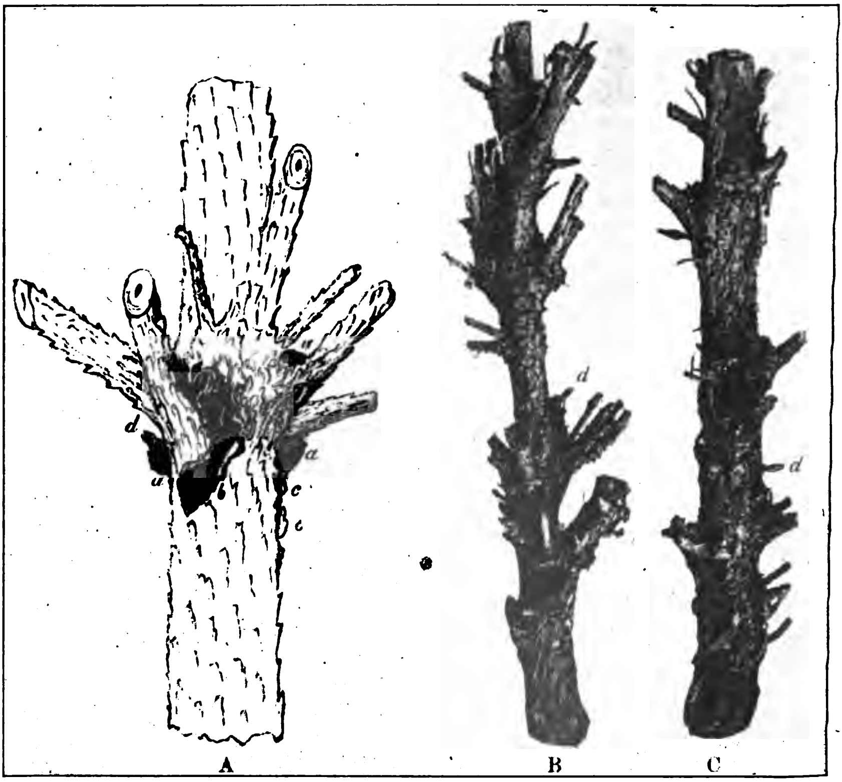


Fig. 43.—Spruce bark tortricid (*Laspeyresia pactolana*): Injury. (Nüsslin.)

### Laspeyresia tedella Clerck (Epiblema).

(Spruce Nest-Worm. Tortricidæ; Lepidoptera.)

*Host:* Spruce (*Picea excelsa, Picea sitchensis*).

*Injury:* Injures the needles.

*Description and biology: Moth*, wing expanse, 12 mm.; forewings golden brown, with brown silvery transverse fascia and finer markings. *Larva* light yellowish brown or greenish with two dorsal lines. Head and thoracic shield brownish black, flecked;

9 mm. long. The larvæ spin nests among the needles. *Pupate* in the ground, where the larvæ hibernate.

*Distribution:* Europe (Germany).

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 285.
Nüsslin, Otto. Leitfaden der Forstinsektenkunde, 2d ed., pp. 412, 413, figs. 344, 345.

### **Dasyneura abietiperda** Henschel; **Dasyneura piceæ** Hartig.

(Spruce Gall Midges. Itonididæ [Cecidomyiidæ]; Diptera.)

*Host:* Spruce.

*Injury:* Attack twigs at the base of needle clusters, injuring dormant buds and sometimes killing entire twig.

*Description:* Europe (Germany).

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 454, 455.

### **Reseliella piceæ** Seitner.

(Spruce Seed Midge. Itonididæ [Cecidomyidæ]; Diptera.)

*Host:* Spruce.

*Injury:* Breeds in the seed.

*Description and injury: Fly*, yellowish red with dark bands, 2–4 mm. long. *Larva*, 4 mm. long, rose-red. *Eggs* laid in young green cones.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten ed. 3, vol. 3, 1913, pp. 448, 449.

## H. OTHER INSECTS ATTACKING SPRUCE (PICEA).

### HEMIPTERA.

**Aphididæ.**

*Lachnus grossus* Kaltenbach, *L. fasciatus* Kaltenbach, *L. piceæ* Walker, and *L. pinicola* Kaltenbach plant lice; Europe; attack stems, twigs, and tender growth.

**Coccidæ:**

Unarmored—
*Phenacoccus piceæ* Löw; Europe; *Picea excelsa.*
*Physokermes piceæ* Schrank; Europe; *Picea alba, P. excelsa, P. pungens, P. sitchensis.*
Armored—
*Syngenaspis parlatoreæ* Sulc.; Bohemia, Bosnia; *Picea excelsa, P. omorica.*

### COLEOPTERA.

**Carabidæ.**

*Calathus fuscipes* Goeze, *Ophonus pubescens* Müller, *Harpalus æneus* Fabricius, and *Pterostichus lepidus* Leske, ground beetles, are destructive to the seed in Europe.

**Elateridæ.**

*Lacon* sp. near *davidi* Fairmaire; India; breeds in trunks of *Picea morinda.*

**Cerambycidæ.**

*Teledapus dorcadioides* Pascoe; a wingless longicorn; India; breeds in trunks of *Picea morinda.*
*Leptura rubriola* Bates; India; breeds in the trunks of *Picea morinda.*

**Ipidæ.**

*Cryphalus morinda* Stebbing; India; attacks *Picea morinda.*
*Hylastes cunicularius* Erichson; Germany; attacks bark and roots.
*Hylurgops glabratus* Zetterstedt; Germany, Siberia.
*Phlœophthorus rhododactylus* Mannerheim; Europe; *Picea excelsa.*
*Phlæophthorus spinulosus* Rey; Europe; attacks branches.
*Pityophthorus exculptus* Ratzeburg; Europe.
*Dryocœtes indicus* Stebbing; India; attacks *Picea morinda.*

**Platypodidæ.**

*Crossotarsus coniferæ* Stebbing; India; bores in wood of *Picea morinda.*

LEPIDOPTERA.

**Tortricidæ.**

*Tortrix histrionana* Froelichs; Germany; attacks shoots.

**Hyponomeutidæ.**

*Argyresthia illuminatella* Zell.; Germany; attacks buds and young shoots.

HYMENOPTERA.

**Tenthredinidæ.**

*Lygæonematus pini* Ratzeburg; the small spruce sawfly; Europe; defoliates and injures buds and young shoots.

*Lygæonematus ambiguus* Fallen and *L. saxeseni* Hartig; Europe; defoliators.

**Siricidæ.**

*Sirex imperialis* Kirby, the spruce wood wasp; India; bores in wood of *Picea morinda* Lind.

*Sirex spectrum* Linnaeus; Europe. (See text fig. 44.)

## I. BETTER KNOWN IMPORTANT PESTS OF LARCH (LARIX).

### **Eriophyes laricis** von Tubeuf.

(Larch Blister Mite. Eriophyidæ; Acarina.)

*Host:* Larch [*Larix decidua* (*europæa*)].

*Injury:* Forms gall-like deformations of the terminal bud.

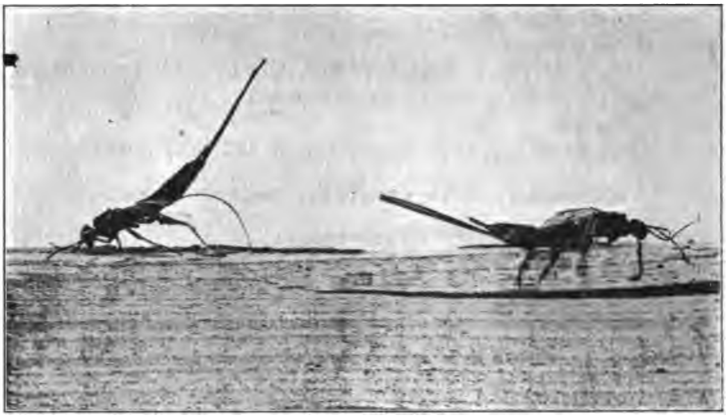


FIG. 44.—Spruce wood wasp (*Sirex spectrum*): Adult attacking *Picea*. (Barbey).

*Description and biology:* A four-legged blister mite which forms gall-like swellings of the terminal or axilary buds. Very easy to introduce on nursery stock.

*Distribution:* Europe.

VON TUBEUF. Forst. naturw. Zeitschr., 1897, Bd. 6, pp. 120–124, 3 figs.

### **Coleophora laricella** Hübner.

(Larch Needle Miner. Elachistidæ; Lepidoptera.)

*Host:* Larch [*Larix decidua* (*europæa*)].

*Injury:* Attacks early buds and mines the needles. The injury is great. Easily introduced in nursery stock.

*Description and biology: Adult* moth 3 mm. long, with wing expanse 9 mm., forewing brownish gray, faintly shining, wings fringed with long hairs. *Larva* dark reddish brown, the little head, thoracic shield, and anal portion dark, 5 mm. long. The larva mines needles and buds. Pupates in a sack or case.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 253.

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., pp. 431–433, figs. 366, 367.

**Argyresthia lævigatella H. S.**

(Larch Shoot Moth. Hyponomeutidæ; Lepidoptera.)

*Host:* Larch (*Larix europæa*).

*Injury:* Very injurious to young shoots.

*Description and biology: Larva* 6–7 mm. long, bright yellow, with black head, feeds under the bark of young larch shoots. After hibernating the larva is somewhat reddish with dark lines. *Eggs* laid singly at bases of needles.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 269.

**Dendrolimus sibiricus Tschetwerikoff.**

(Larch Spinner. Lasiocampidæ; Lepidoptera.)

*Host:* Larch.

*Injury:* Considerable.

*Description:* Similar to *D. pini* L.

*Distribution:* Ural.

TSCHETWERIKOFF. Rev. Russ. Ent., vol. 8, 1908, pp. 1–7, 3 figs.

**Laspeyresia zebeana** Ratzeburg (**Grapholitha**).

(Larch Gall Moth. Tortricidæ; Lepidoptera.)

*Host:* Larch (*Larix europæa*).

*Injury:* Forms galls on twigs, giving admission to disease or causing deformity. Liable to introduction in nursery stock during the winter.

*Description and biology: Moth,* wing expanse 17 mm., forewings grayish black with whitish transverse lines on the costal margin. *Larva* dirty yellow green with brown thoracic shield, 10 mm. long. The larva attacks the twigs at the axils of branches forming a gall-like swelling. (See text fig. 45.)

*Distribution:* Germany.

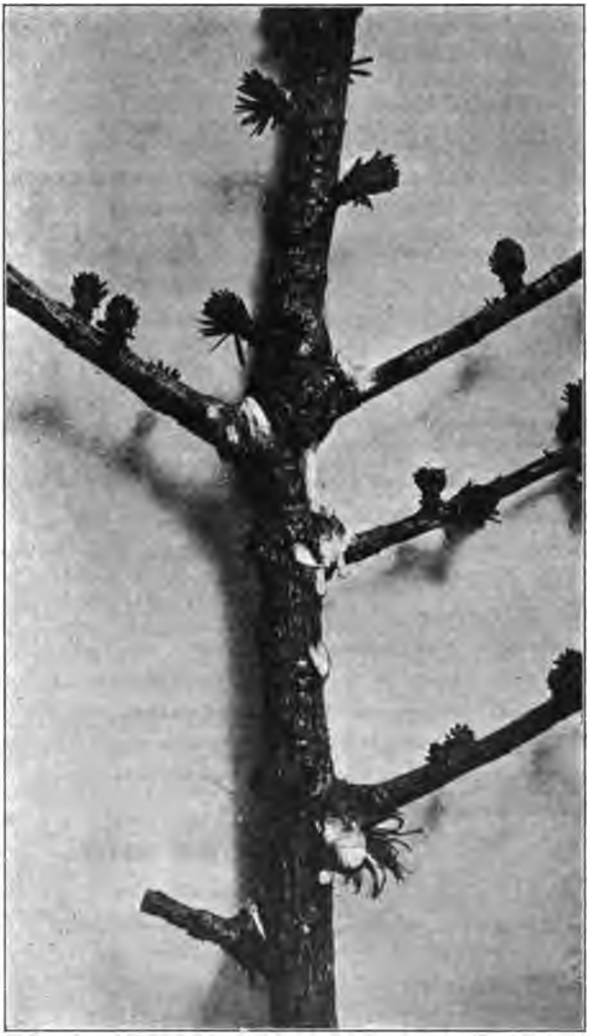


FIG. 45.—Larch gall moth (*Laspeyresia zebeana*): Injury. (Barbey.)

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 282.

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., pp. 422–424, figs. 356, 357.

### Dasyneura laricis F. Lw.

(Larch Bud Gall Midge. Itonididæ [Cecidomyidæ]; Diptera.)

*Host:* Larch.

*Injury:* Attacks buds, forming galls.

*Description and biology: Eggs* laid at base of needle clusters. The larvæ enter the dormant buds forming a gall-like swelling, and overwinter as very small larvæ. They develop in the buds through the year. Pupate in cocoon in autumn. The attacked buds die.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 454, 455.

## J. OTHER INSECTS ATTACKING LARCH (LARIX).

### HEMIPTERA.

**Aphididæ.**

*Lachnus laricis* Koch, a plant louse; Europe; attacks needles and young shoots.

### COLEOPTERA.

**Anobiidæ.**

*Dryophilus pusillus* Gyllenhal; Europe; attacks buds.

**Ipidæ.**

*Cryphalus intermedius* Ferrari; Germany.

### LEPIDOPTERA.

**Hyponomeutidæ.**

*Argyresthia lævigatella* H. Sch.; Germany; attacks young shoots.

## L. BIBLIOGRAPHY OF PRINCIPAL WORKS CONSULTED.

BARGAGLI, P. Rassegna Biologica Rincofori Europei, 1883–1887.

FERNALD, M. E. Catalogue Coccidæ of the World, Mass. Exp. Sta., bull. 88, 1903.

GILLANDERS, A. T. Forest Entomology, 1908.

HESS, R. Der Forstschutz, vols. 1, 2, 1898.

LINDINGER, L. Die Schildläuse (Coccidæ), 1912.

NÜSSLIN, O. Leitfaden der Forstinsektenkunde, 2d ed., 1913.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., vol. 3, 1913.

STEBBING, E. P. A Manual of Elementary Forest Zoology for India, 1908.

STEBBING, E. P. Indian Forest Insects. Coleoptera., 1914.

TRÄGARDH, IVAR. Sveriges skogsinsekter, 1914.

# CORN; MAIZE.

(*Zea mays* Linnæus. Family Gramineæ.)

Although the greater part of our commerce in corn is in the nature of exports, there are always likely to be imports of seed corn from various parts of the world. Corn is probably American in origin, and consequently there are few foreign pests not already widely distributed in the country.

## A. CORN INSECTS LIKELY TO BE IMPORTED.

### * Aræcerus fasciculatus De Geer.

(Coffee-bean Weevil. Family Anthribidæ; Coleoptera.)

*Hosts:* This weevil is polyphagous, feeding in dry food products and drugs, chinaberries (*Melia azedarach*), dead cotton bolls, cornstalks, etc.

*Injury:* Very injurious to food products and also to live corn.

*Description:* A mottled grayish weevil with short, blunt snout. Larva hairy.
*Distribution:* Cosmopolitan.

TUCKER, E. S. U. S. Dept. Agr., Bur. Entomology, Bul. 64, pt. 7, 1909, pp. 60–64, pl. 3, fig. 18.

CHITTENDEN, F. H. U. S. Dept. Agr., Bur. Entomology, Bul. 8, n. s., 1897.

### **Dichocrocis punctiferalis** Guénée.

(Pyralidæ; Lepidoptera.)

*Hosts:* Maize, peach, pawpaw, apple, orange, loquat, guava, cassia, custard apple, granadilla, banana, millet, *Canavalia indica*, senna bean, *Dahlia*, castor bean, cacao, sunflower.

*Injury:* Although primarily a maize pest, it is becoming quite a serious enemy of fruit trees in Cleveland District, Queensland. Breeds in pods of castor bean and cacao, and heads of sunflower in India.

*Description and biology:* Adult measures about 24 mm. in wing expanse; color pale orange yellow, marked with numerous black dots on wings and body. Egg presumably deposited on leaf stalk near or at point of junction with main stem or young fruit; larva on hatching penetrates into the hollow stalk or fruit, and after feeding for a time bores into the crown, in which it remains until ready to pupate. On leaving the crown of the fruit it crawls to some convenient crevice and constructs a loose silken web under which it transforms to a reddish brown pupa.

*Distribution:* Australia, Japan, China, India, Burma, Ceylon.

JARVIS, E. Queensland Agricultural Journal, 1913, p. 33, July.

MAXWELL-LEFROY, H. Mem. Dept. Agric. India, vol. 1, 1907, p. 211.

### **Siphonella pumilionis** Bjerk.

(Corn Fly. Oscinidæ; Diptera.)

*Host:* Corn.

*Injury:* Mines stem and young ears.

*Description and biology:* *Fly* yellow, thorax with three broad black stripes, abdomen with brown median line and four broad brown cross bands; beak very long and thin; appendages yellow; length 3–4 mm. *Larva* 6–7 mm. long, shining yellowish white.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 411.

## B. IMPORTANT CORN PESTS.

### HEMIPTERA.

**Cercopidæ.**
*Tomaspis varia* Fabricius, *T. postica* Walker, *T. lepidior* Font.; South America. (See Sugar cane.)

### COLEOPTERA.

**Elateridæ.**
*Agriotes lineatus* Linnæus. (See Tobacco.)

**Chrysomelidæ.**
*Diabrotica graminea* Ballou; Porto Rico; adults very injurious to flowers.

**Brachyrhinidæ.**
*Diaprepes abbreviatus* Linnæus; West Indies. (See Sugar cane.)

### LEPIDOPTERA.

**Noctuidæ.**
*Sesamia cretica* Led.; Europe, Asia Minor, Egypt, Sudan; bores in ears. (See Sugar cane.)
*Calamistis fusca* Hampson; South Africa; a serious pest.
*Cirphis leucosticha* Hampson; East Africa; cobworm.

**Pyralidæ.**
*Pyrausta nubilalis* Hübner; Europe; bores in stalks. (See Grains.)
*Chilo simplex* Butler; India, Formosa. (See Sugar cane.)
*Chilo auricilia* Dudgeon; India. (See Rice.)

**Hepialidæ.**
*Hepialus humuli* Linnæus; Europe. (See Hops.)

## COTTON.

(*Gossypium* spp. Malvaceæ.)

Many species of fiber yielding cotton are cultivated in various parts of the world, and the fiber is a very important article of world commerce. The great impetus given to seed selection in recent years has also caused considerable commerce in the various varieties of seed for planting. Practically the only serious possibility of importing cotton insects is connected with the seed and with lint when not thoroughly cleaned of seed. There is also some danger of injurious insects finding refuge behind the bagging of the bales. Owing to these dangers the Federal Horticultural Board has forbidden the importation of cotton seed except through the Department of Agriculture, and has placed restrictions on the importation of foreign baled cotton.

The cotton plant is one of the most severely attacked cultivated plants, having a very long list of injurious insects. Although the majority of these insects are not liable to introduction, there is always a possibility that they may find entrance into the country in the folds of the bagging of bales or on some food plant.

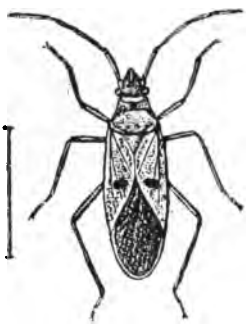


FIG. 46.—Cotton stainer (*Dysdercus cingulatus*): Adult. (Maxwell-Lefroy.)

### A. BETTER KNOWN COTTON INSECTS LIKELY TO BE IMPORTED.

#### **Eriophyes gossypii** Banks.

(Cotton Blister Mite. Eriophyidæ; Acarina.)

*Host:* Cotton.

*Injury:* Injures the foliage, causing death to plants when very numerous. May be distributed on lint or seed.

*Description and biology:* A tiny four-legged mite which forms blisters on the leaves of cotton when very young, developing therein. This is a very serious pest.

*Distribution:* West Indies.

SMITH, LONGFIELD. Rept. Agric. Exp. Sta. St. Croix for 1912–13, Copenhagen, 1914, pp. 56–58.

#### **Dysdercus** spp.

(Cotton stainers. Pyrrhocoridæ; Hemiptera.)

*Important species:* This genus contains the following species, which are very injurious to cotton because of their habits of sucking the juices and staining the fiber: *D. andreæ* Linnæus, West Indies. *D. annuliger* Uhler, West Indies. *D. cardinalis* Gerstäcker, of East Africa. *D. cingulatus* Fabricius, India, Ceylon, Burma, Malay Peninsula, Australia, and Egypt (see text, fig. 46). *D. delauneyi* Lethierry, Egypt, India, and the West Indies. *D. fasciatus* Signoret, Africa. *D. fernaldi* Ballou, West Indies. *D. howardi* Ballou, West Indies. *D. insularis*, Fiji. *D. nigrofasciatus* Stål, West Africa. *D. pacificus*, Fiji. *D. ruficollis* Linnæus, Brazil, Peru, and Mexico. *D. sanguinarius*, Cuba. *D. sidæ* Montrousier, New South Wales. *D. superstitiosus* Fabricius, Africa. ✳*D. suturellus* H. S., North America, West Indies.

*Hosts:* Cotton, okra, eggplant, and various other plants.

*Injury:* Serious.

*Description and biology:* Adult active sucking bugs, usually reddish or yellowish in color. The developmental stages are gradual, each nymphal molt showing a little more of the wings. The eggs are small, oval, yellowish, laid in clusters on the ground. The insect in all stages lives by sucking the juices of the cotton plant, especially the bolls.

Ballou, H. A. Cotton Stainers, West India Bul., 1906, vol. 7, No. 1, pp. 64–85.

Basu, S. K., and Hutt, H. L. *Dysdercus cingulatus* Fabr.: Crop Pest Handbook for Behar and Orissa, 1913, Dept. Agr. Behar and Orissa, Calcutta, Leaflet 45, pl. 32.

### **Apion xanthostylum** Wagner.

(East African Cotton Weevil. Apionidæ; Coleoptera.)

*Host:* Cotton.

*Injury:* Bores in the stem and bolls.

*Description and biology:* A very small black weevil. The larva is yellowish white, 2 mm. long, curved and legless. It bores in the stem and roots as well as in the bolls of cotton and is a very serious pest.

*Distribution:* German East Africa.

Zacher, Friedrich. Arbeit. Kaiserlich. Biol. Anst. f. Land- und Forstwirtschaft, band 9, heft 1, 1913, pp. 157–163, figs. 21–27.

### **Apion armipes** Wagner.

This species is similar to the above mentioned and attacks cotton in a similar manner in Nyassaland. (Zacher., l. c., p. 156, fig. 21.)

### **Anthonomus vestitus** Boheman.

(Peruvian Cotton-Square Weevil. Curculionidæ; Coleoptera.)

*Host:* Cotton.

*Injury:* Very injurious pest to squares in Peru.

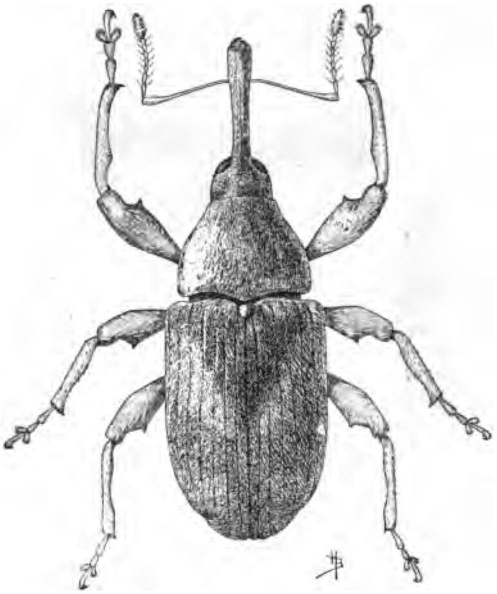


Fig. 47.—Peruvian cotton square weevil, *Anthonomus vestitus*, male. (Pierce.)

*Description and biology: Adult* weevil resembles the Mexican cotton boll weevil (*A. grandis*); length 2.5–4 mm.; oblong-ovate, convex, blackish piceous, rather closely clothed with elongate whitish scales, with indistinct oblique lighter band on each elytron, the two forming a basal triangle. *Pupa* white, formed in fallen squares. *Larva* white, curved, legless; feeds in the interior of cotton squares which fall to the ground soon after the larva commences to feed. *Egg* oval, white, laid in square (see text fig. 47).

*Distribution:* Peru.

Townsend, C. H. T. Journ. Econ. Ent. 1911, vol. 4, No. 2, pp. 241–248.

Pierce, W. Dwight. Proc. U. S. Nat. Mus. 1912, vol. 42, No. 1889, pp. 155–156.

Pierce, W. Dwight. U. S. Dept. Agric., 1915, Report 102, p. 12, pl. 2, fig. 3.

### **Earias insulana** Boisduval.

(Egyptian Cotton Bollworm. Cymbidæ; Lepidoptera.)

*Host:* Cotton.

*Injury:* Very injurious; the larvæ feed in the bolls and squares. Adults have been captured in quarantine in a few bolls of cotton from the island of Cyprus shipped for propagation and botanical purposes.

***Description and biology: Adult*** **moth green, front wings with two indistinct lines, hind wings whitish. *Larva* brownish to greenish with yellow flecks 15 mm. long (see plate XVI, figs. *a, b, c, e, g, h*).**

***Distribution:*** **India, Siam, Burma, Australia, Africa, Cyprus.**

**ZACHER, FRIEDRICH. Arbeit. Kaiserlich. Biolog. Anst. f. Land- u. Forstwirtschaft, band 9, heft 1, 1913, pp. 175–179, figs. 35–39.**

### Pectinophora gossypiella Saunders (Gelechia).

### (The Pink Bollworm. Gelechiidæ; Lepidoptera.)

*Host:* Cotton.

*Injury:* Breeds in the bolls, especially in the seed. Liable to be imported in cotton seed. Live specimens have been taken in quarantine in the United States. Some of these were in stray seeds in baled cotton.

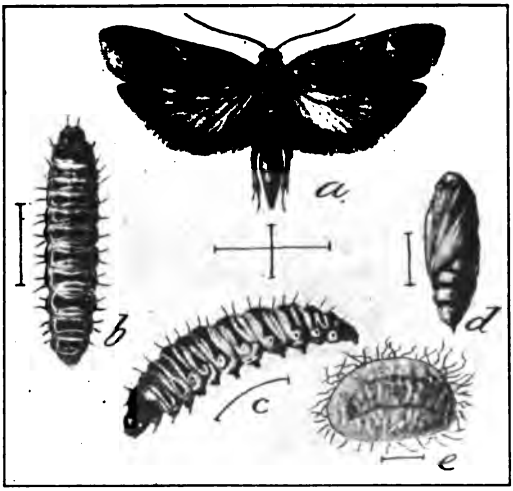


FIG. 48.—Cotton pink bollworm (*Pectinophora gossypiella*): *a*, Adult; *b, c*, larvæ; *d*, pupa; *e*, cocoon. (Maxwell-Lefroy.)

*Description and biology: Moth*—small, gray colored, less than half an inch long, with long brown fringes on the wings. *Pupa* brown, less than half an inch in length. *Larva* white when very young, but becoming pink; feeds in green or ripe bolls, first attacking the leaves or outside of bolls; later it bores inside of the boll, feeding on the seed. The larval period is sometimes very greatly retarded. Eggs deposited singly on leaves, stalks, and bolls hatch in a few days. (See text fig. 48.)

*Distribution:* India, Africa, Hawaii, New Caledonia. Has become established in the Laguna District, State of Coahuila, Mexico.

MAXWELL-LEFROY, H. F. Indian Insect Pests, pp. 93–96.

MAXWELL-LEFROY, H. F. The Insect Pests of Cotton in India, Agricultural Journal of India, vol. 1, pp. 49–62.

BASU, S. K., and DUTT, H. L. Crop Pest Handbook for Behar and Orissa, 1913, Dept. Agr. Behar and Orissa, Calcutta, Leaflet 44, pl. 31.

### Pyroderces simplex Walsingham.

### (The Little Bollworm. Gelechiidæ; Lepidoptera.)

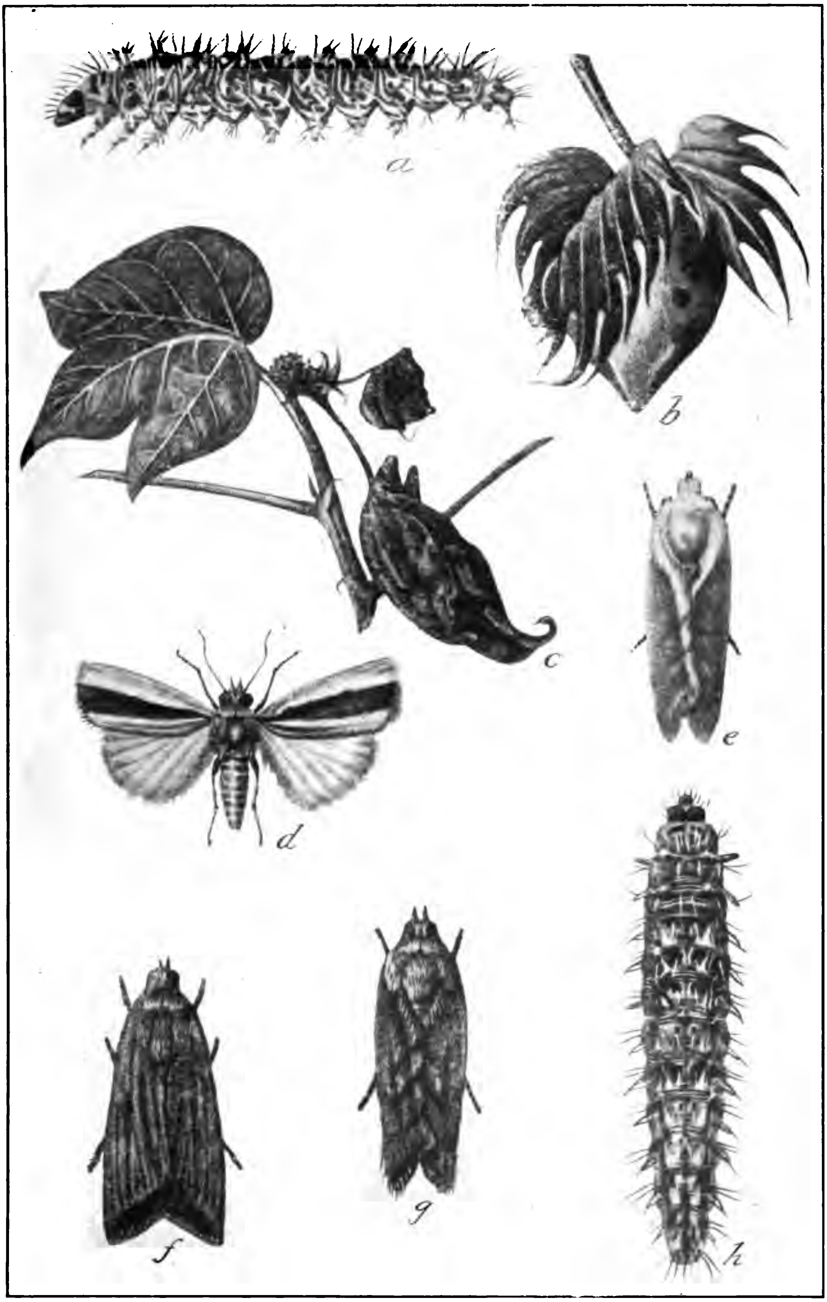
*Host:* Cotton.

*Injury:* Breeds in the bolls, especially in the seed.

*Description and biology: Adult* moth light brown, with black and white markings, length 6 mm. *Larva* pink, 8 mm. long. *Pupa* light brown, 5 mm. long. The species greatly resembles *Pectinophora gossypiella* but is smaller and differently marked. It breeds in the same manner.

*Distribution:* East Africa.

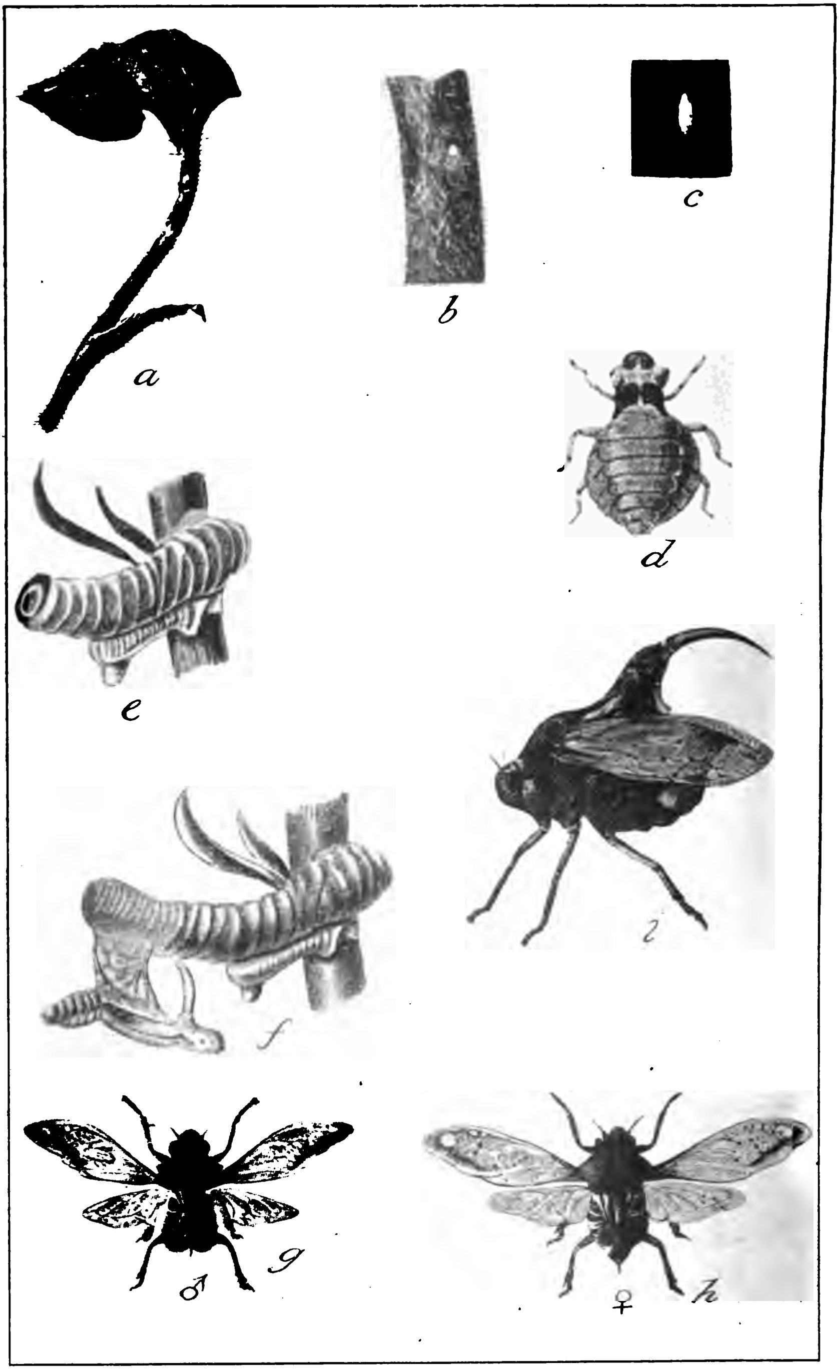
MORSTATT, H. Der Pflanzer, Jahrg. 10, beiheft 1, 1914, pp. 29–31.



COTTON BOLLWORMS.

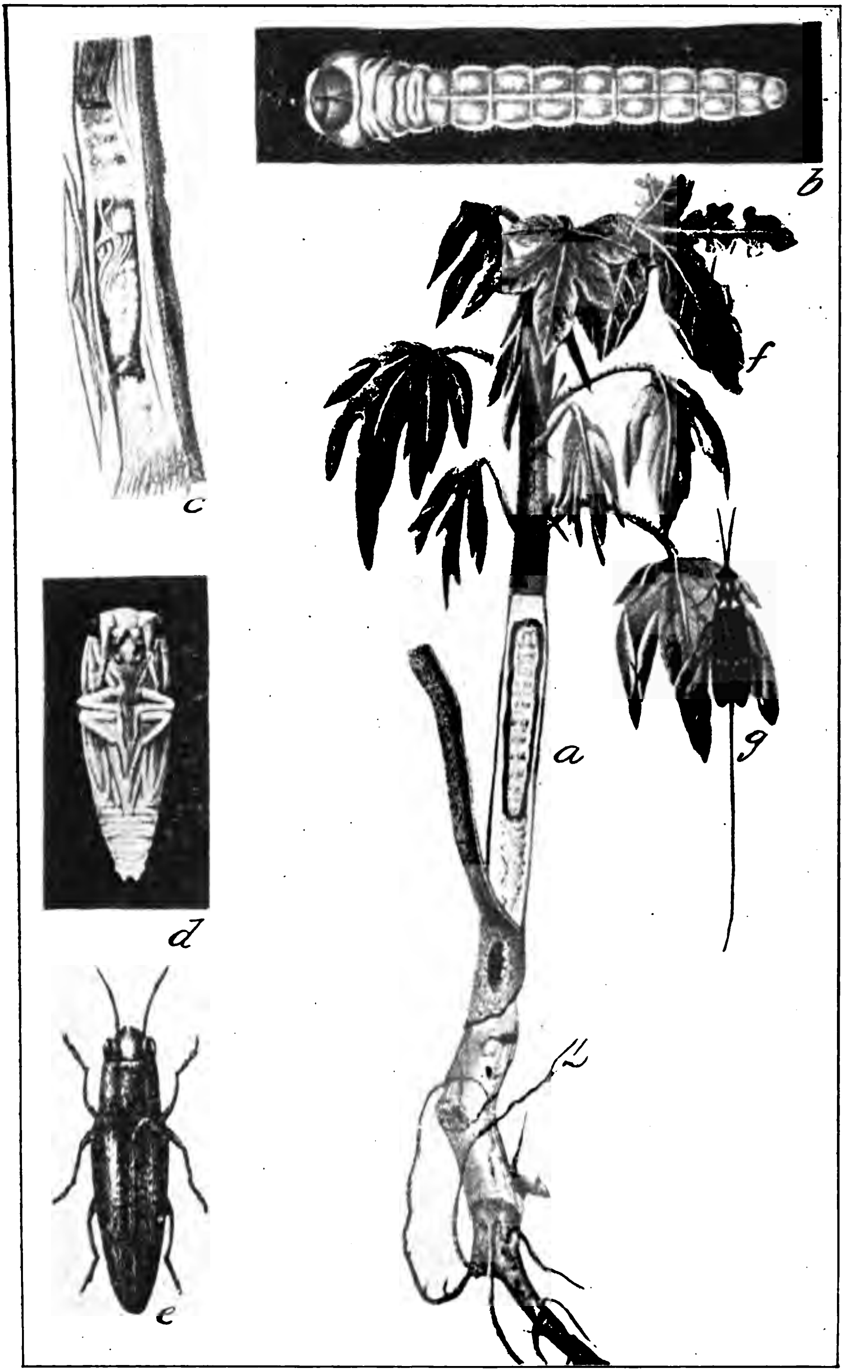
Cotton bollworms: *Earias insulana*. FIGS. *a, h,* Larva: *b,* injured cotton boll; *c,* injured twig; *e, g,* adult moths. *Earias chromataria* FIG. *f,* Adult. *Earias fabia* Stoll. FIG. *d,* Adult. (Maxwell-Lefroy.)

PLATE XVII.



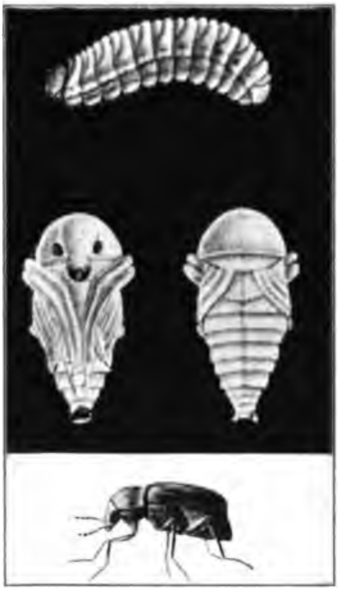
THE COTTON SPITTLE-TUBE INSECT.

The cotton spittle-tube insect (*Machærota planitiæ*): FIG. *a*.—Eggs on cotton stem; *b*, egg imbedded in tissue of stem; *c*, egg; *d*, nymph, 19 days old; *e*, calcareous case of nymph, 20 days old; *f*, case with molted skin attached; *g*, male; *h*, female; *i*, side view of adult. (Maxwell-Lefroy.)

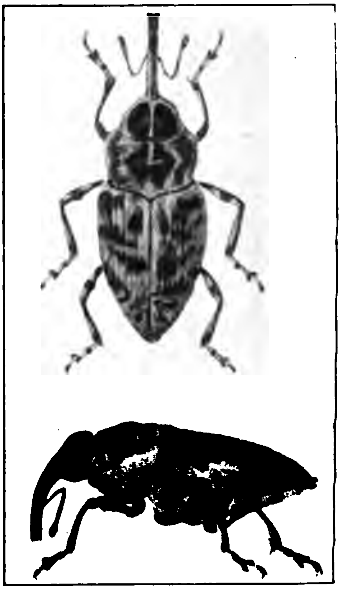


THE COTTON STEM-BORER.

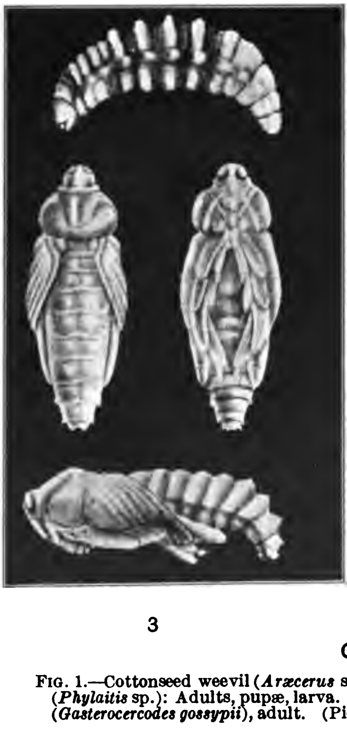
The cotton stem-borer (*Sphenoptera gossypii*): *a*, Larva in stalk; *b*, larva; *c*, pupa in stalk; *d*, pupa; *e*, adult; *f*, adult on plant; *g*, parasite. (Maxwell-Lefroy.)



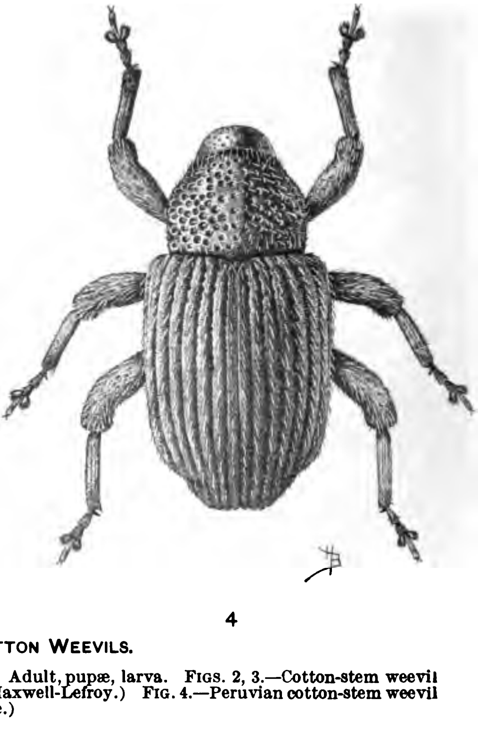
1



2



3



4

## COTTON WEEVILS.

FIG. 1.—Cottonseed weevil (*Aræcerus* sp.): Adult, pupæ, larva. FIGS. 2, 3.—Cotton-stem weevil (*Phylaitis* sp.): Adults, pupæ, larva. (Maxwell-Lefroy.) FIG. 4.—Peruvian cotton-stem weevil (*Gasterocercodes gossypii*), adult. (Pierce.)

**Contarinia gossypii** Felt.

(Cotton Flower Bud Maggot. Itonididæ. Cecidomyiidæ; Diptera.)

*Hosts:* Cotton, wild cotton, privet.

*Injury:* Very serious pest of the flower buds in Antigua.

*Description and biology: Adult* fly 1 to 1.5 mm. long; face fuscous, yellowish, eyes large, black; mesonotum dark brown, the submedian lines yellowish; scutellum and postscutellum yellowish; abdomen greenish yellow. *Pupa* formed in ground. *Larva* 2 mm. long, changing from white to yellow or orange as it grows; infests the flower buds of cotton, causing the bracts to flare and squares to drop (see text fig. 49).

*Distribution:* Antigua, St. Croix.

Ballou, H. A. The Flower-Bud Maggot of Cotton, West Indian Bull., vol. 10, No. 1, pp. 1–28, figs. 1–9.

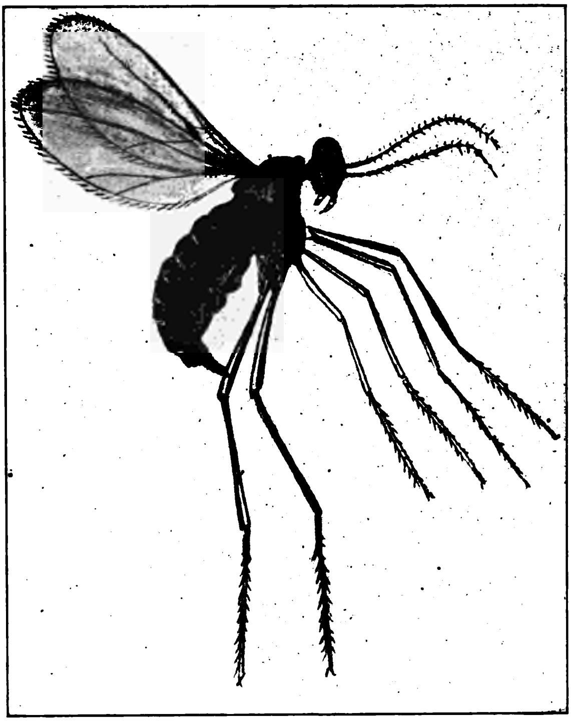


Fig. 49.—Cotton flower bud-maggot (*Contarinia gossypii*): Adult. (Ballou.)

**Porricondyla gossypii** Coquillett.

(Red Maggot of Cotton. Itonididæ [Cecidomyiidæ]; Diptera.)

*Host:* Cotton.

*Injury:* Kills growing part of plant by girdling stem.

*Description and injury: Adult* fly very small. *Larvæ*, red maggots, feed under the bark of the stems of the cotton plant, which they may completely girdle, causing the death of the parts above.

*Distribution:* Barbados, Montserrat.

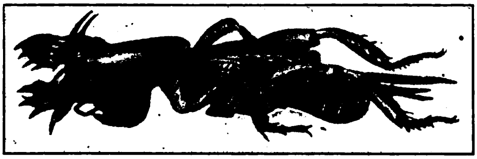


Fig. 50.—Mole cricket (*Gryllotalpa africana*). (Maxwell-Lefroy.)

## B. IMPORTANT COTTON INSECTS.

### ORTHOPTERA.

**Acrididæ and Locustidæ.**

*Chrotogonus trachypterus* Blanchard; India.

*Acridium peregrinum* Olivier and *A. hieroglyphicum;* Egypt and Sudan.

*Acheta bimaculata* De Geer; Formosa.

**Grylloidæ.**

*Gryllotalpa africana* Pallas; India, Africa, New Holland, Tropical Asia. (See text fig. 50.)

*Schizodactylus monstrosus* Drury; Egypt, Sudan, India. (See text fig. 51.)

## HEMIPTERA.

**Cercopidæ.**

*Machærota planitiæ* Distant; India; makes tubes on stems, sucks juices. (See pl. XVII.)

**Lygæidæ.**

*Oxycarenus gossipinus* Distant; of West Africa; *O. dudgeoni* Distant of West Africa; *O. hyalinipennis* Costa of Egypt; *O. lætus* Kirby of Ceylon, India, Burma; attack cotton seed.

*Oncopeltus quadriguttatus* Fabricius; Australia; oviposits in stems.

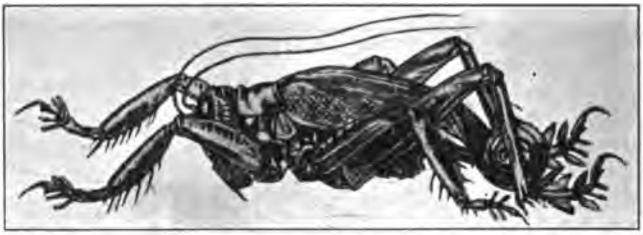


FIG. 51.—Mole cricket (*Schizodactylus monstrosus*). (Maxwell-Lefroy.)

## COLEOPTERA.

**Scarabæidæ.**

*Adoretus umbrosus* Fabricius, and var. *tenuimaculatus* Waterhouse; Hawaii, Philippines, Japan, Java. (See Rose.)

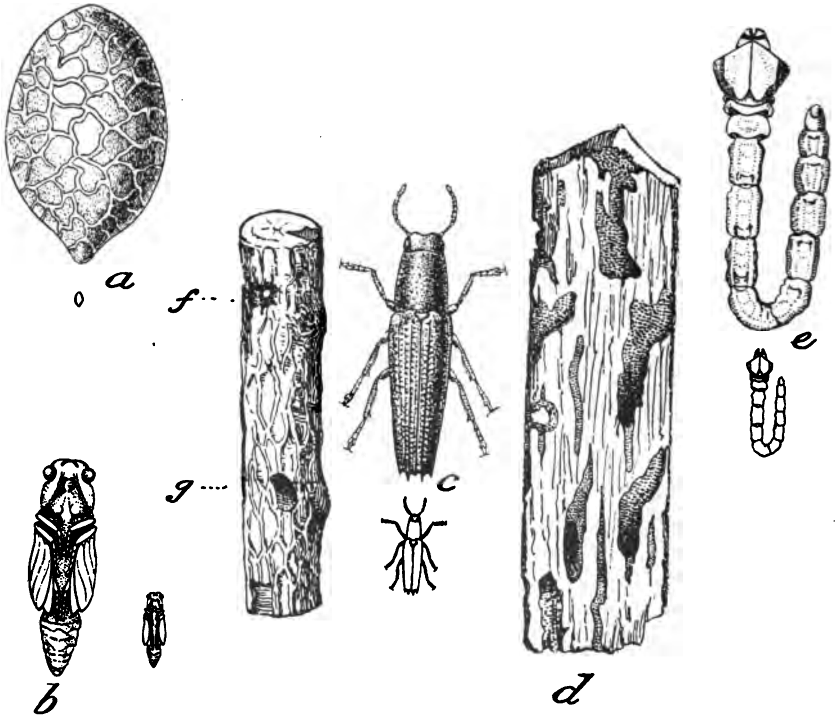


FIG. 52.—Cotton stem-borer (*Sphenoptera neglecta*): *a*, Egg; *b*, pupa, *c*, adult; *d*, *f*, *g*, injury; *e*, larva. (Zacher.)

**Buprestidæ.**

*Sphenoptera neglecta* Klug (see text fig. 52), Egypt, and *S. gossypii* Kerr, India; bore in stalks. (See plate XVIII.)

**Curculionidæ.**

*Phylaitis* sp.; India; and *Gasterocercodes gossypii* Pierce, Peru; bores in stalks. (See pl. XIX, figs. 2, 3, 4.) (Pierce. W. D., U. S. Dept. Agr., Off. Secy., Report 102, 1915, plate I.)

**Anthribidæ.**

✳*Araecerus fasciculatus* DeGeer; India; breeds in seed (see pl. XIX, fig. 1.) (See Corn.)

LEPIDOPTERA.

**Phycitidæ.**

*Phycita infusella* Meyrick; India; attacks buds.

**Pyralidæ.**

*Cryptoblabes gnidiella* Miller; Egypt, Europe; breeds in bolls.
*Sylepta derogata* Fabricius; India; rolls leaves.

**Cossidæ.**

*Zeuzera coffeæ* Nietner; Orient; bores in stalks. (See Coffee.)

**Cymbidæ.**

*Earias fabia* Stoll. (see pl. XVI, fig. *d*) of India, Ceylon, and Australia; *E. chromataria* Walker (see pl. XVI, fig. *f*) of India and Togo; *E. plaga* Feld. of East Africa; *E. chlorana* Hübner of Egypt and Java; *E. gossypii* of Egypt; boll worms.

**Noctuidæ.**

*Euxoa segetis* Schiffermiller; Europe, Asia, East Africa, Canary Islands, Madeira, South Africa; cutworm.
*Prodenia litura* Fabricius; Egypt, Uganda, India, Philippines; defoliator.
*Diparopsis castanea* Hampson; Africa; boll worm.
*Sacadodes pyralis* Dyar; South America, Trinidad; boll worm.
*Tarache catena* Sow.; India; defoliator.

**Arctiidæ.**

*Diacrisia obliqua* Walker; India, Japan, China; defoliator.

**Lymantriidæ.**

*Porthesia virguncula* Walker; India, Uganda; defoliator.

## COWPEA.

(*Vigna unguiculata* Walp. Family Leguminosæ.)

The cowpea is extensively raised in the country as well as many other parts of the world. Shipments of the peas might easily introduce pests. (See Beans, Peas.)

## CRUCIFERS.

(Family Cruciferæ.)

Various insects attack several species of crucifers and for convenience are grouped under a general heading.

### Phyllotreta spp.

(Crucifer Leaf Beetles. Chrysomelidæ; Coleoptera.)

*Species: Ph. undulata* Kutsch; Europe; cultivated crucifers. *Ph. nemorum* Linnæus; Russia; rhubarb, hops, cabbage. *Ph. atra* Fabricius; Europe; crucifers. *Ph. cruciferæ* Goeze; Europe; crucifers. *Ph. nigripes* Fabricius; Europe; cabbage, radish, horseradish, rape, *Reseda*. ✳*Ph. armoraciæ* Koch; Europe, introduced into North America; crucifers, horseradish.

*Injury:* The adults of all of these species feed on the foliage of cruciferous plants The larvæ are not all known but they usually attack the stem or roots. The fact that two of the species have been introduced into this country indicates the possibility of the others also gaining admission.

*Description:* The first two species are yellow striped, the others unicolorous.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 525.
Chittenden, F. H. U. S. Dept. Agr., Div. Entomology, bul. 9, n. s., 1897, pp. 21-28.

**Ceutorhynchus contractus Marsh.**

(The Charlock Weevil. Curculionidæ; Coleoptera.)

*Injury:* This minute weevil sometimes does great harm early in the season to young sprouting mustard plants by devouring the germinating seed or the young plant just below the surface of the ground.

*Host:* Charlock, (*Brassica arvensis* Linn.)

Ormerod, E. A. 17th Report, Injurious Insects, p. 74.

## CUCURBITS; MELONS; CUCUMBER.

(Family Cucurbitaceæ.)

There are many species of melons grown in various parts of the world, but the only danger of importation comes from pests of the seed and fruit.

### A. BETTER KNOWN CUCURBIT INSECTS LIKELY TO BE IMPORTED.

**Epilachna** spp.

(Cucurbit Ladybird Beetles. Coccinellidæ; Coleoptera.)

*Species: Epilachna chrysomelina* Fabricius; Mediterranean region, Sudan, German East Africa; cucurbits, *Sesamia*. *E. 28-punctata* Fabricius; Asia, Malaysia, Australia; Solanaceæ, Cucurbitaceæ. *E. dodecastigma* Mulsant; Asia, Malaysia, Australia; Solanaceæ, Cucurbitaceæ. *E. argus* Fourcroy; Southern Europe; *Bryonia dioica* and other cucurbits.

*Injury:* Defoliate.

*Description:* Beetle of *E. chrysomelina* round, very convex, yellowish red with six round black spots on each elytron; length 7–9 mm. The larvæ as well as the adults feed on the foliage.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 477.

**Aulacophora olivierei** Guérin.

(Banded Pumpkin Beetle. Chrysomelidæ; Coleoptera.)

*Hosts:* Cucurbitaceæ, pumpkin, marrow, cucumber, gourd, peach, nectarine.

*Injury:* Very serious. The adults skeletonize the leaves, and eat the flowers; the larvæ feed in the roots and lower parts of the stem.

*Description:* Beetle about 8 mm. long; orange yellow with large black spots at humeri and beyond middle on each elytron. The adults are rather gregarious in habits.

*Distribution:* Australia.

French, C. Handbook of Destructive Insects of Victoria, pt. 4, 1909, pp. 123–127, pl. 81.

**Baris trægardhi** Aurivillius.

(Melon Weevil. Curculionidæ; Coleoptera.)

*Hosts:* Sweet melons.

*Injury:* Breeds in the fruit among the seed.

*Description and biology: Adult* weevil 4 to 6 mm. long, black, with a long slender, curved beak, antennæ elbowed and clubbed. *Pupa* white, with appendages folded beneath. *Larva* white, legless, with light brownish head.

*Distribution:* Sudan.

King, H. H. Fourth Rept. Wellcome Tropical Research Laboratories, 1911, vol. B, Genl. Science, p. 137, pl. 8, figs. 1, 3, 4, 6.

### Carpomyia pardalina Bigot.

(Melon Fruit Fly. Trypetidæ; Diptera.)

*Hosts:* Melons.

*Injury:* Serious.

*Description and biology: Adult* fly, wing expanse 11 mm., wings with three yellowish bands, color light brown, thorax with black and white spots. *Larva* feeds in fleshy fruits, pupates in the soil. *Egg* laid in skin of fruit.

*Distribution:* India.

Maxwell-Lefroy, H. M. Mem. Dept. Agric., India, 1907, vol. 1, No. 2, p. 229, fig. 72.

### Dacus cucurbitæ Coquillett.

(Cucurbit Fly. Trypetidæ; Diptera.)

*Hosts:* Cucurbitaceæ (melons, gherkins, etc.), tomatoes, beans.

*Injury:* Breeds in fruits and stems.

*Description and biology: Fly* marked with red, brown, yellow, black, and white; wing with brown band and apical spot. *Eggs* laid on skin of fruit.

*Distribution:* India, Ceylon, Hawaii.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 415, 416.

## B. OTHER IMPORTANT CUCURBIT INSECTS.

DIPTERA.

**Trypetidæ.**

- *Ceratitis capitata* Wiedemann, attacks squash. (See Fruit.)
- *Dacus ferrugineus* Fabricius; India, etc. (See Fruit.)
- *Bactrocera tryoni* Froggatt; Orient. (See Fruit.)
- *Rhagoletis pardalina* Bigot; India; attacks fruit.

LEPIDOPTERA.

**Pyralidæ.**

- **Pionea ferrugalis* Hübner; Europe, Asia, North America. (See Cabbage.)

## CURRANT.

See Gooseberry.

## CUSTARD APPLE; SOUR SOP.

(*Annona* spp. Family Anonaceæ.)

Tropical trees cultivated for their large fruits. Some of the species have been introduced into Florida.

## A. A BETTER KNOWN SPECIES LIKELY TO BE IMPORTED.

### Anonæpestis bengalella Ragonot.

(Custard-apple Caterpillar. Phycitidæ; Lepidoptera.)

*Host:* Custard apple (*Annona squamosa*).

*Injury:* Injures fruit by tunneling.

*Description: Adult female* length 22 mm.; fore wings dark green, hind wings brownish-gray with purplish tint, head and thorax brownish-ochreous, abdomen ochreous.

*Distribution:* India.

Moore, F. Indian Museum Notes, 1896, vol. 3, No. 3, p. 106.

## B. OTHER IMPORTANT ANNONA INSECTS.

HEMIPTERA.

**Coccidæ:**

- Armored—
  - *Aspidiotus* (*Chrysomphalus*) *personatus* Comstock; Porto Rico; *Annona reticulata, A. muricata.*
  - *Aulacaspis miranda* Cockerell; Mexico; *Annona cherimola.*

**Coccidæ**—Continued.
Unarmored—
*Ceroplastes denudatus* Cockerell; Grenada, Antigua, Demerara; *Annona muricata*.
*Ceroplastes quadrilineatus* Newstead; British East Africa, Uganda; *Annona muricata*.
* *Ceroputo yuccæ* Coquillett; Mexico, California; *Annona cherimola*.
*Coccus marsupialis* Green; Ceylon.
*Icerya albolutea* Cockerell; West Africa; *Annona squamosa*.
*Lagosinia strachani* Cockerell; W. Africa; *Annona squamosa*.
* *Pseudococcus bromeliæ* Bouché; Hawaii; *Annona muricata*.
* *Saissetia nigra* Nietner; West Indies; Ceylon.

LEPIDOPTERA.

**Pyralidæ.**
*Dichocrocis punctiferalis* Guénée; Queensland. (See Corn.)

DIPTERA.

**Trypetidæ.**
*Anastrepha fraterculus* Wiedemann, attacks *Annona humboldtiana*. (See Fruit.)
*Ceratitis capitata* Wiedemann; attacks *Annona muricata*. (See Fruit.)
*Ceratitis anonæ* Graham; Africa; attacks *Annona muricata*. (See Fruit.)

## CYPRESS.

(*Cupressus* spp. Family Juniperaceæ.)

Trees or shrubs with aromatic evergreen foliage in Central America, California, Arizona, Southern Europe to Southeast Asia, valuable for timber and ornament.

### INSECTS INJURIOUS TO CYPRESS (CUPRESSUS).

HEMIPTERA.

**Coccidæ:**
Armored—
* *Chionaspis striata* Newstead; Algeria, Egypt, California, Arizona.
*Diaspis visci* Schrank; Europe; *Cupressus funebris*, *C. glauca*, *C. macrocarpa*, *C. pyramidalis*, *C. sempervirens*.
Unarmored—
*Gueriniella serratulæ* Fabricius; Algeria, Southern France.

COLEOPTERA.

**Buprestidæ.**
*Diadoxus scalaris* L. & G., and *D. erythrurus* White; Australia; bore in *Cupressus lambertiana*.

BIBLIOGRAPHY.

LINDINGER, L., Die Schildläuse (Coccidæ), 1912.
FROGGATT, W. W., Australian Insects, 1907.

## CYPRESS; CEDAR.

(*Chamæcyparis* spp. Family Juniperaceæ.)

Evergreen trees of North America and Japan, highly valued for timber and useful ornamental trees.

### INSECTS INJURIOUS TO CHAMÆCYPARIS.

HEMIPTERA.

**Coccidæ:**
Armored—
*Diaspis visci* Schrank; Europe; *Chamæcyparis nutkaensis*, *C. obtusa*, *C. pisifera*.

BIBLIOGRAPHY.

LINDINGER, L. Die Schildläuse (Coccidæ), 1912.

## DATE PALM.

(*Phoenix dactylifera*. Family Palmaceæ.)

A palm cultivated for its fruit, the date of commerce. (See Palms.)

## DOGWOOD.

(*Cornus* spp. Family Cornaceæ.)

Hardy ornamental shrubs or trees of the northern hemisphere and Peru. The bark of some species is used in obtaining a substitute for quinine, for tooth powder, black ink, etc.; the bark of the roots yields a scarlet dye, the wood is hard and good for tool handles.

### IMPORTANT DOGWOOD INSECTS.

HEMIPTERA.

**Coccidæ:**
Armored—
*Chionaspis salicis* Linnæus; Europe; *Cornus sanguinea*.
Unarmored—
*Lecanium coryli* Linnæus; Europe; *Cornus sanguinea*, *C. sericea*.

## DURRA.

See Sorghum.

## EGGPLANT.

(*Solanum melongena*. Family Solanaceæ.)

A tropical vegetable now extensively cultivated in this country for its fruit.

### A. EGGPLANT INSECT LIKELY TO BE IMPORTED.

#### Leucinodes orbonalis Guénée.

(Eggplant Fruit Borer. Pyralidæ; Lepidoptera.)

*Host:* Eggplant.

*Injury:* Bores in the fruit.

*Description and biology: Adult* wing expanse 24 mm., white, forewing with fulvous, black and ferruginous markings; hind wing white, with black lines and specks. *Larva* about 15 mm. long, flesh color, with brown head and shield; a few short hairs on round dark spots.

*Distribution:* India, Java, Burma, Ceylon, South Africa.

MAXWELL-LEFROY, H. M. Mem. Dept. Agric. India, vol. 1, 1907, p. 214, fig. 65.

### B. IMPORTANT EGGPLANT INSECTS.

DIPTERA.

**Trypetidæ.**
*Lonchæa splendida;* New Zealand, Australia, Oceanica; attacks fruit. (See Tomato.)

LEPIDOPTERA.

**Noctuidæ.**
*Micromima olivia*; Cuba; leaf roller on tomato, tobacco and eggplant.

## ELM.

(*Ulmus* spp. Family Urticaceæ.)

Ornamental deciduous trees distributed throughout the colder and temperate regions of the northern hemisphere, some of them much valued as avenue trees. The wood is very hard and valuable in the manufacture of implements.

### IMPORTANT ELM INSECTS.

HEMIPTERA.

**Aphididæ.**
*Colopha compressa* Koch, *Eriosoma lanuginosa* Hartig, *Tetraneura pallida* Haliday, *Eriosoma ulmi* Linnæus, *Tetraneura ulmi* DeGeer; Europe; attack foliage of elms.

**Coccidæ.**
Armored—
*Chionaspis salicis* Linnæus; Europe; *Ulmus campestris*.

**Coccidæ**—Continued.

Unarmored—

***Gossyparia spuria* Modeer; Europe.

*Guerinicella serratulæ* Fabricius; Italy.

*Lecanium coryli* Linnæus; Europe; *Ulmus campestris*, *U. montana*.

## COLEOPTERA.

**Bostrychidæ.**

*Sinoxylon perforans* Schr.; Europe; bores in branches.

*Xylonites retusus* Olivier; Europe; bores in branches and trunks.

**Buprestidæ.**

*Lampra decipiens* Mannerheim and *L. rutilans* Fabricius; Europe; bore in the bark, bast and sapwood.

**Scarabæidæ.**

*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus; Europe; larvæ injure roots of seedlings.

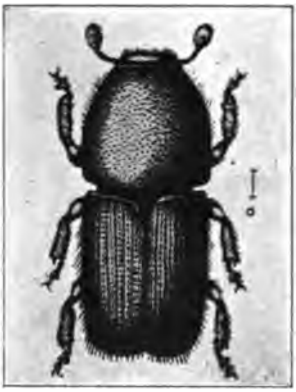


FIG. 53.—Elm barkbeetle (*Scolytus multistriatus*): Adult. (Nüsslin.)

**Cerambycidæ.**

*Aeolesthes sarta* Solsky; India; bores in trunks.

*Oberea linearis* Linnæus; Europe; bores in pith of nursery stock of cork elm.

**Curculionidæ.**

*Magdalis aterrima* Linnæus; Europe; makes galleries under the bark and in injured branches.

*Orchestes alni* Linnæus; Europe; mines the leaves of *Ulmus campestris*.

*Orchestes ferrugineus* Marsham and *O. rufus* Olivier; Europe mine the leaves.

**Scolytidæ.**

*Pteleobius kraatzi* Eichhoff; Russia; galleries in bark.

*Pteleobius vittatus* Fabricius; Germany, Russia; galleries in bark.

*Scolytochelus ensifer* Eichhoff; Russia; galleries in bark of branches.

*Scolytochelus kirschi* Skal.; Russia; galleries in bark of smooth bark elms.

*Scolytus lævis* Chapuis and *S. pygmæus* Fabricius; Europe; galleries in bark of tops and branches.

*Scolytus mali* Bechst.; Europe.

*Scolytus multistriatus* Marsham; Europe (see text fig. 53).

*Scolytus scolytus* Fabricius; Europe; attacks all parts of trunk and branches.

*Xyleborus dryographus* Ratzeburg and *X. monographus* Fabricius; Europe; galleries in wood.

## LEPIDOPTERA.

**Cossidæ.**

*Cossus cossus* Linnæus; goat moth; Europe; bores in wood. (See Willow.)

**Zeuzera pyrina* Linnæus; Europe; bores in wood. (See Horse chestnut.)

**Notodontidæ.**

*Phalera bucephala* Linnaeus; Europe. (See Forests.)

**Noctuidæ.**

*Xylina socia* Rott.; Europe. (See Plum.)

**Geometridæ.**

*Boarmia crepuscularia* Hübner; Europe, Asia. (See Cinchona.)

*Hibernia defoliaria* Linnæus; Europe; defoliator.

*Larentia dilutata* Borckh.; Europe; defoliator.

## LITERATURE.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
NÜSSLIN, O. Leitfaden der Forstinsektenkunde, 2d ed., 1913.
HESS, R. Der Forstschutz, 1898, 1900.
STEBBING, E. P. Indian Forest Insects, Coleoptera, 1914.
BARGAGLI, P. Rassegna Biologica Rincofori Europei, 1883–87.
LINDINGER, L. Die Schildläuse (Coccidæ), 1912.

## EUCALYPTUS; GUM.

(*Eucalyptus* spp.)

Valuable Australian trees recently introduced into California.

### A. BETTER KNOWN EUCALYPTUS INSECTS LIKELY TO BE IMPORTED.

### Mictis profana Fabricius.

(Gum-tree Bug. Coreidæ; Hemiptera.)

*Hosts: Eucalyptus viminalis, Acacia decurrens, A. mollissima*, orange, other citrus fruits.

*Injury:* Sucks the juices from tender twigs, causing death of the new parts.

*Description:* A large brown bug about an inch long, with long sucking proboscis, with acute teeth at posterior corners of thorax. Greatly resembles *Leptoglossus.* The immature stages are soft and marked with yellow.

*Distribution:* Australia.

French, C. Handbook of Destructive Insects of Victoria, pt. 4, 1909, pp. 68–71, pl. 70.

### Stigmodera heros Gehin.

(She-Oak Root Borer. Buprestidæ; Coleoptera.)

*Hosts:* She-oak and Bull-oak (*Casuarina*); also *Eucalyptus.* Adults frequent flowers of *Melaleuca*, etc.

*Injury:* Tunnels in the lower portions of the trunk of trees.

*Description and biology: Beetles* large yellowish brown with dark blackish legs. Larvæ large yellowish white with powerful jaws. The eggs are laid in areas cleared by the female in the butts of the trees. The larvæ bore in and down through the wood for several feet.

*Distribution:* Australia.

French, C. Handbook of Destructive Insects of Victoria, pt. 5, 1911, pp. 114–116, pl. 121.

### Phoracantha tricuspis Newman; Phoracantha recurva Newman.

(Yellow-box Borers. Cerambycidæ; Coleoptera.)

*Hosts: Eucalyptus viminalis.*

*Injury:* Very destructive borers.

*Description: Beetles* light brown with darker markings on the elytra. The head and thorax are very dark brown. *Pupæ* yellowish white. *Larvæ* bore in the wood. *Eggs* are deposited in crevices in the bark.

*Distribution:* Victoria.

French, C. Handbook of Destructive Insects of Victoria, pt. 5, 1911, pp. 70–73, pl. 112.

### Distichocera macleayi Newman.

(Feathery-horned Yellow-box Borer. Cerambycidæ; Coleoptera.)

*Hosts: Eucalyptus stuartiana, E. viminalis.*

*Injury:* Bores in the wood.

*Description:* Female beetle reddish brown in color, larger than the male, which is black with beautiful featherlike antennæ. *Pupa* yellowish white. *Larva* dull, yellowish white, unusually tapering at apex. The adults frequent the flowers of the *Leptospermum* bushes.

*Distribution:* Australia.

French, C. Handbook of Destructive Insects of Victoria, pt. 5, 1911, pp. 96–98, pl. 107.

### Tryphocharia mastersi Pascoe.

(Masters' Gum Borer. Cerambycidæ. Coleoptera.)

*Hosts: Eucalyptus amygdalina, E. globulus.*

*Injury:* Bores in the wood, the larvæ taking several years for development.

*Description: Adult* over an inch long, with long antennæ, brown, with broad yellow elytral band; thorax laterally dentate. Pupa elongate white. Larva cylindrical yellowish, with small head and broader prothorax, chitinous.

*Distribution:* Australia.

French, C. Handbook of Destructive Insects of Victoria, pt. 4, 1909, pp. 98–101, pl. 76.

### Bimia femoralis Saunders.

(Apple-gum Borer. Cerambycidæ; Coleoptera.)

*Host: Eucalyptus stuartiana.*

*Injury:* Bores in the trunk, causing much damage. A severe scar appears on the surface of the bark where the burrow commences.

*Description:* The sexes are different in appearance, the male having antennæ much larger than the body; the female antennæ considerably shorter than the body. Elytra with yellow band at base, remainder of elytra brown. Head, thorax and tip of abdomen yellow in female; head and center of prothorax brown in male. Larva of female much broader, less attenuate, and with larger prothorax than in adult female.

*Distribution:* Australia.

French, C. Handbook of Destructive Insects of Victoria, pt. 4, 1909, pp. 110–113, pl. 78.

### Strongylorhinus ochraceus Schaum.

(Red Gum-tree Weevil. Curculionidæ; Coleoptera.)

*Host: Eucalyptus melliodora.*

*Injury:* Larvæ bore in twigs causing gall-like deformation. Very injurious.

*Description:* A reddish-brown weevil about 12 mm. long with short, stout beak. Larva curved, legless, white, makes a cone shaped burrow in the wood.

*Distribution:* Australia.

French, C. Handbook of Injurious Insects of Victoria, pt. 4, 1909, pp. 128–130, pl. 82.

## B. OTHER IMPORTANT EUCALYPTUS INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—
- *Aspidiotus (Aonidiella) miniatæ* Green; Australia; *Eucalyptus miniata.*
- *Aspidiotus alatus* Froggatt; Australia; *Eucalyptus rostrata.*
- *Aspidiotus confusus* Froggatt; Australia.
- *Aspidiotus tasmaniæ* Green; Australia.
- *Chionaspis frenchi* Green; Australia.
- *Lecaniodiaspis convexus* Froggatt; Australia.
- *Lecaniodiaspis frenchi* Froggatt; Australia.
- *Lecaniodiaspis newmanni* Froggatt; Australia.

Unarmored—
- *Apiomorpha attenuata* Froggatt; Australia.
- *Apiomorpha bäuerleni* Froggatt; Australia.
- *Apiomorpha calycina* Tepper; South Australia; *Eucalyptus dumosa, E. oleosa.*
- *Apiomorpha conica* Froggatt; Australia; *Eucalyptus viminalis, E. uncinata.*
- *Apiomorpha duplex* Schrader; Australia.
- *Apiomorpha ellipsoidalis* Tepper; Australia.
- *Apiomorpha floralis* Froggatt; Australia.
- *Apiomorpha helmsii* Fuller; Australia.
- *Apiomorpha karschi* Rübsaamen; Australia.
- *Apiomorpha maliformis* Fuller; Australia; *Eucalyptus patens.*
- *Apiomorpha minor* Froggatt; New South Wales; *Eucalyptus hæmastoma.*

**Coccidæ**—Continued.

Unarmored—Continued.

*Apiomorpha munita* Schrader; Australia; *Eucalyptus robusta, E. siderophloia.*

*Apiomorpha ovicola* Schrader; Australia; *Eucalyptus hæmastoma, E. gracilis, E. leucoxylon, E. rostrata.*

*Apiomorpha ovicoloides* Tepper; Australia; *Eucalyptus incrassata.*

*Apiomorpha pedunculata* Fuller; Australia.

*Apiomorpha pharetrata* Schrader; New South Wales; *Eucalyptus sieberiana, E. corymbosa, E. capitellata.*

*Apiomorpha pileata* Schrader; New South Wales.

*Apiomorpha pomiformis* Froggatt; Australia; *Eucalyptus rostrata.*

*Apiomorpha rugosa* Froggatt; Australia.

*Apiomorpha sessilis* Froggatt; Australia.

*Apiomorpha sloanei* Froggatt; Australia.

*Apiomorpha strombylosa* Tepper; Australia; *Eucalyptus incrassata.*

*Apiomorpha thorntoni* Froggatt; Australia.

*Apiomorpha umbellata* Froggatt; Australia.

*Apiomorpha urnalis* Tepper; New South Wales; *Eucalyptus uncinata, E. gracilis, E. melliodora, E. polyanthemos.*

*Apiomorpha variabilis* Froggatt; Australia; *Eucalyptus piperita.*

*Ascelis attenuata* Froggatt; Australia; *Eucalyptus piperita.*

*Ascelis echiniformis* Fuller; West Australia; *Eucalyptus tessellaris.*

*Ascelis præmollis* Schrader; Australia; *Eucalyptus corymbosa.*

*Ascelis schraderi* Froggatt; Australia; *Eucalyptus corymbosa.*

*Ceronema caudata* Froggatt; Australia; *Eucalyptus robusta.*

*Ctenochiton eucalypti* Maskell; Australia; *Eucalyptus siderophloia.*

*Eriococcus confusus* Maskell; Australia; *Eucalyptus viminalis.*

*Eriococcus coriaceus* Maskell; Australia.

*Eriococcus eucalypti* Maskell; Australia, Tasmania; *Eucalyptus diversicolor.*

*Eriococcus simplex* Maskell; Australia.

*Eriococcus crofti* Froggatt; Australia; *Eucalyptus piperita.*

*Eriococcus gregarius* Froggatt; Australia, New Zealand.

*Eriococcus irregularis* Froggatt; Australia; *Eucalyptus piperita.*

*Eriococcus serratilobis* Green; Australia; *Eucalyptus gracilis.*

*Eriococcus picta* Froggatt; Australia.

*Eriococcus tesselatus* Froggatt; Australia.

*Eriococcus spiniger* Maskell; Australia.

*Eriococcus tepperi* Maskell; Australia, Tasmania; *Eucalyptus globulus.*

*Opisthoscelis conica* Fuller; Australia.

*Opisthoscelis fibularis* Froggatt; Australia.

*Opisthoscelis globosa* Rübsaamen; New South Wales; *Eucalyptus capitellata.*

*Opisthoscelis maculata* Froggatt; New South Wales; *Eucalyptus gracilis, E. leucoxylon.*

*Opisthoscelis mammularis* Froggatt; Australia.

*Opisthoscelis maskelli* Froggatt; Australia.

*Opisthoscelis nigra* Froggatt; Australia.

*Opisthoscelis pisiformis* Froggatt; New South Wales, Australia; *Eucalyptus melliodora, E. robusta, E. resinifera, E. piperita.*

*Opisthoscelis serrata* Froggatt; Australia.

*Opisthoscelis spinosa* Froggatt; Australia; *Eucalyptus siderophloia.*

*Opisthoscelis subrotunda* Schrader; Australia; *Eucalyptus capitellata.*

*Opisthoscelis verrucula* Froggatt; Australia.

*Pseudococcus lobulatus* Maskell; Australia; *Eucalyptus globulus.*

## ISOPTERA.

**Termitidæ.**

*Termes australis* Hagen; Australia. (See Apple.)

## LEPIDOPTERA.

**Arctiidæ.**

*Nola metallopa* and *Spilosoma fuscinula;* Australia; attacks the foliage.

*Termissa nivosa;* Australia; larvæ found under the bark in August.

**Bombycidæ.**

*Ocinara lewinii* Lewin; Australia; attacks foliage.

**Geometridæ.**

*Crypsiphona occultaria* and *Gastrophora henricaria;* Australia; defoliate.

*Mnesampela privata* Gn.; Australia; defoliator.

**Lasiocampidæ.**

*Odonestis australasiæ* Fabricius; Australia; defoliator.

**Lymantriidæ.**

*Teara contraria* Walker; and *Trichetra marginalis*, Australia; defoliators

**Hepiolidæ.**

*Charagia lignivora* Lewin; Australia. (See Apple.)

DIPTERA.

**Itonididæ (Cecidomyiidæ).**

*Diplosis eucalypti* Skuse, *D. paralis* Skuse, and *Lasioptera miscella* Skuse; Australia; breed in twigs.

LITERATURE.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
FROGGATT, W. W. Australian Insects.

## EUGENIA spp.

(Family Myrtaceæ.)

Fruit-bearing trees of South America, etc., cultivated in the Southern States and California.

DIPTERA.

**Trypetidæ.**

*Anastrepha fraterculus* Wiedemann. (See Fruit.)

*Ceratitis capitata* Wiedemann, attacks *Eugenia braziliensis*, *E. jambos*, *E. malaccensis*, *E. uniflora*. (See Fruit.)

*Dacus ferrugineus* Fabricius; India, etc., attacks fruit of *Eugenia malaccensis*. (See Fruit.)

## FIG; ASSAM RUBBER; BANYAN.

(*Ficus* spp. Family Urticaceæ.)

This is a very large genus of valuable plants, including the fig (*Ficus carica*), the India or Assam rubber plant (*F. elastica*), and the banyan (*F. benghalensis*). Many varieties of the fig are prized for their fruit. The India rubber of commerce is derived from *F. elastica*. Other varieties are popular in conservatories.

### A. BETTER KNOWN FIG INSECTS LIKELY TO BE IMPORTED.

**Sinoxylon sudanicum Lesne.**

(Fig stem-boring beetle. Bostrychidæ; Coleoptera.)

*Host:* Fig.

*Injury:* Bores in the twigs of young trees.

*Description and biology: Adult* beetle, brown with basal half of elytra tinged with yellow, about one-quarter inch long. The apex of the elytra is concave bituberculate. The adult bores in twigs near the buds and girdles the twig under the bark, laying its eggs in the outer portion which soon falls to the ground. The species is especially dangerous to nursery stock just planted, as it does not usually attack strong healthy trees.

*Distribution:* Sudan.

KING, HAROLD H. Fourth report. Wellcome Tropical Research Lab. Khartoum, vol. B, Gen'l Science, p. 140, pl. 9, fig. 1.

**Colobogaster quadridentata Fabricius.**

(Family Buprestidæ; Coleoptera.)

HOST: Cultivated fig (*Ficus carica*).

*Injury:* Injury occasioned by galleries made by larvæ in trunk and twigs. Liable to be introduced in cuttings or plants.

*Description and biology: Adult* beetle 25–30 mm. long, 11–12 mm. broad; blue black, with small points of metallic green. Practically entire life spent in plant.

*Distribution:* Brazil.

Bondar, Gregorio: Os insectos damninhos no Agricultura, 1913, p. 4.

### Batocera boisduvali Hope.

(Fig-tree borer. Family Cerambycidæ; Coleoptera.)

*Hosts: Ficus macrophylla, F. australis.*

*Injury:* Bores in stems and branches of damaged and freshly fallen trees.

*Adult:* A beautiful grayish-green beetle, about 2 inches long, with a row of white marks on the elytra; very strong, heavy antennæ; prothorax laterally armed with very strong spine on each side. Pupa light brown. Larva about 3 inches long, very robust, head black.

*Distribution:* Queensland.

French, C. Handbook of Destructive Insects of Victoria, 1911, pt. 5, pp. 134–137, pl. 126.

### Tæniotes scalaris Fabricius.

(Family Cerambycidæ; Coleoptera.)

*Host*: Cultivated fig (*Ficus carica*).

*Injury:* Injury due to galleries made by larvæ.

*Description and biology: Adult* beetle 15–30 mm. in length; general color obscure, nearly black, with spots and streaks of yellow; triangular spot between the eyes, and behind the eyes is situated a half-moon-like spot. Practically entire life is spent in the plant.

*Distribution:* Brazil.

Bondar, Gregorio: Os insectos damninhos no Agricultura, 1913, p. 9, figure.

### Hellipus bonelli Boheman.

(Brazil Fig Borer. Curculionidæ; Coleoptera.)

*Host:* Cultivated fig (*Ficus carica*).

*Injury:* Larvæ make galleries in trunks and branches of fig. Liable to be introduced on plants or cuttings.

*Description and biology: Adult* weevil 12 mm. long, with characteristic designs on thorax and elytra, color light coffee brown, with symmetrical yellow spots. Larvæ and pupæ white. Practically the whole life cycle is spent in the tree.

*Distribution:* Brazil.

Bondar, Gregorio. Os insectos damninhos no Agricultura, 1913, p. 11. Figures injury, larvæ, pupa, and adult.

### Hylesinus porcatus Chapuis.

(The Fig-Branch Borer. Scolytidæ; Coleoptera.)

*Host:* Fig.

*Injury:* Occasioned by tunneling of insect. Liable to be imported in cuttings or plants.

*Description and biology:* Adult beetle short, thickset, rounded, general color black, varying to reddish brown in immature specimens; head and thorax slightly rugose and lightly covered with fine hairs. Breeds in galleries in twigs, entering just above a bud. (See plate xx.)

*Distribution:* New South Wales.

Froggatt, W. W. Agric. Gaz. New South Wales, 1899, vol. 10, pt. 4, p. 268.

## B. OTHER IMPORTANT FICUS INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—

_Aspidiotus_ (_Aonidia_) _planchonioides_ Green; Ceylon (Botanic Gardens).
*_Aspidiotus_ (_Aonidiella_) _cocotiphagus_ Marlatt; Cuba.
_Aspidiotus_ (_Aonidiella_) _subcuticularis_ Green; Australia; _Ficus orbicularis._
_Aspidiotus_ (_Chrysomphalus_) _personatus_ Comstock; West Indies; Mexico; British Guiana; England (in greenhouses).
_Aspidiotus_ (_Diaspidiotus_) _africanus_ Marlatt; South Africa.
_Aspidiotus_ (_Morganella_) _maskelli_ Cockerell; Bermuda.
*_Aspidiotus_ (_Pseudaonidia_) _articulatus_ Morgan; Jamaica.
_Aspidiotus_ (_Pseudaonidia_) _clavigera_ Cockerell; Honolulu.
_Aspidiotus_ (_Pseudaonidia_) _silvatica_ Lindinger; German East Africa ,Kamerun; _Ficus indica._
_Aspidiotus_ (_Pseudaonidia_) _trilobitiformis_ Green; East India, Ceylon, Mauritius, Japan, Brazil; _Ficus scandens_ (see text fig. 32.)
_Aspidiotus_ (_Pseudaonidia_) _obsita_ Cockerell and Robinson; Philippines; _Ficus caudatifolia._
_Schizaspis lobata_ Cockerell and Robinson; _Ficus nota._
_Chionaspis manni_ Green; India.
*_Conchaspis angræci_ Cockerell; established in Florida, and has doubtless been imported from Mexico and Jamaica on numerous occasions. Scale of female approximately circular, conical, apex bluntly pointed, radiating from apex are six to eight strong ridges or carinæ.
_Diaspis bromeliæ_ (Kern); Mexico.
_Hemichionaspis fici_ Green; Bengal; _Ficus glomerata, F. carica._
_Hemichionaspis minima_ Green; India.
_Lepidosaphes ficifolii_ Berlese; Algeria, Italy; _Ficus carica._
_Lepidosaphes mexicana_ Cockerell; Mexico.
_Lepidosaphes minima_ Newstead; Algeria; _Ficus carica._

Unarmored—

_Anomalococcus cremastogastri_ Green; Ceylon; _Ficus religiosa._
_Asterolecanium pustulans_ Cockerell; Jamaica, Porto Rico, Antigua, Brazil, British Guiana, Grenada, Montserrat; fig.
_Ceroplastes ceriferus_ Anderson; Ceylon; _Ficus walkeriana._
_Ceroplastes ficus_ Newstead; German East Africa; test of adult female hemispherical, thin, semitransparent shaded with gray and brown.
_Ceroplastes gowdeyi_ Newstead; Uganda Protectorate.
_Ceroplastes myricæ_ Linnæus; Greece; fig.
_Ceroplastes quadrilineatus_ Newstead; British East Africa; test of adult provided with a pair of large divergent pyriform bodies, four white lines across dorsum.
_Ceroplastes rubens_ Maskell; Australia, Hawaii, Japan; _Ficus macrophylla._
_Ceroplastes rusci_ Linnaeus; Europe, British Guiana, Algeria, Australia, Japan; adult female covered with wax in the form of plates; attacks _Ficus elastica_ and _F. carica._
_Ceroplastes townsendi percrassus_ Cockerell; Mexico; adult female covered with wax of a faint yellowish tint without division into plates.
_Ceroputo yuccæ_ Coquillett; Mexico.
_Drosicha maskelli_ Cockerell; Japan, China, Java.
_Eriococcus crispus_ Fonscolombe; France.
_Eriococcus lagerstrœmiæ_ Kuwana; Japan.
_Icerya ægyptiaca_ Douglas; Egypt; adult female forms a white waxy secretion; along the margin of the body are fragile white processes.
_Icerya palmeri_ Riley & Howard; Guatemala.
_Icerya maxima_ Newstead; Africa.
_Icerya seychellarum_ Westwood; Natal, Africa. (See Citrus.)
_Lecaniodiaspis africana_ Newstead; Egypt.
_Lichtensia lutea_ Cockerell; Mexico; fig.
_Monophlebus stebbingi octocaudata_ Green; India; _Ficus carica, F. benghalensis, F. infectoria, F. religiosa, F. glomerata;_ adult male provided with four fleshy tassels on each side of the abdomen.
_Neolecanium plebeium_ Cockerell; Mexico.
_Paralecanium expansum_ Green; India, Australia; _Ficus retusa._
_Pseudococcus ficus_ Signoret; France, Calabria.
_Pseudococcus setosus_ Hempel; Brazil.
_Pseudococcus virgatus_ Cockerell; Africa.
_Pulvinaria ficus_ Hempel; Brazil.
_Pulvinaria jacksoni_ Newstead; W. Africa.
_Pulvinaria mammeæ_ Maskell; Natal; fig.
*_Saissetia nigra_ Nietner; Hawaii, Ceylon, West Indies, India; _Ficus glomerata._

**Coccidæ**—Continued.

Unarmored—Continued.

*Tachardia fici* Green; India; *Ficus religiosa.*

*Tachardia lacca* Kerr; British Guiana, India, Ceylon; *Ficus elastica, F. carica, F. glomerata, F. indica, F. infectoria, F. laccifera, F. nervosa, F. obtusifolia, F. religiosa, F. rumphii, F. tjakela, F. comosa, F. cordifolia, F. cunia, F. palmata.*

*Vinsonia stellifera* Walker; British Guiana; *Ficus altissima.* (See Coffee.)

**Pentatomidæ.**

*Peltophora pedicillata* Kirby; Australia. (See Plum.)

### COLEOPTERA.

**Buprestidæ.**

*Lampra assamensis* Stebbing; India; on *Ficus elastica.*

**Chrysomelidæ.**

*Crioceris impressa* Fabricius; India; feeds on foliage of *Ficus elastica.*

*Podontia 14-punctata* Linnæus; India; a defoliating leaf beetle on *Ficus elastica.*

**Cerambycidæ.**

*Xoanodera regularis* Gahan; India; bores between the bast and sapwood of *Ficus elastica.*

*Xylotrechus gahani* Stebbing; India; bores in the branches of *Ficus elastica.*

*Batocera rubra* Linnæus; India; bores in the trunk of fig trees (*Ficus carica*), causing much injury. (See pl. XXI.)

*Batocera albofasciata* DeGeer; India, Java, Kamerun; an important borer in *Ficus elastica.*

*Batocera frenchi;* Australia; bores in native fig trees.

*Olenecamptus bilobus* Fabricius; India; bores in *Ficus rumphii, F. glomerata,* and *F. roxburghii.*

*Phryneta spinator* Fabricius; East Africa; bores in *Ficus elastica.*

*Phryneta conradti* Kolbe, East Africa; bores in *Ficus elastica.*

*Petrognatha gigas* Fabricius var. *spinosa;* West and East Africa; attacks *Ficus* spp.

*Rosenbergia megacephala*; Australia; bores in fig trees.

**Curculionidæ.**

*Curculio amœnus* Fabricius (*Balaninus*); Australia; breeds in the fruit of *Ficus rubiginosa.*

*Alcides scenicus* Faust; India; in *Ficus elastica.*

**Scolytidæ.**

*Diamerus fici* Blandford; India; attacks nursery stock of *Ficus elastica.*

*Hypoborus ficus* Erichson; Europe; galleries in bark of figs.

### DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann; attacks fruit of *Ficus carica.* (See Fruit.)

### LEPIDOPTERA.

**Bombycidæ.**

*Gunda sikkima;* India; attacks foliage of *Ficus elastica.*

*Ocinara dilectula* Walker and *O. signifera* Walker; Java; attack foliage of *Ficus bergmanniana* and *F. elastica.*

### LITERATURE.

STEBBING, E. P. Indian Forest Insects, Coleoptera, 1914.
STEBBING, E. P. A Manual of Forest Zoology for India, 1908.
SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.

## FIR.

(*Picea* spp., *Abies* spp. Family Pinaceæ.)

Tall, pyramidal, evergreen trees growing in the northern and mountainous regions of the northern hemisphere. The wood is soft and perishable, but valuable products, such as balsam, are obtained from the exudations. For convenience the insect pests are arranged under Conifers.

## FLAX.

(*Linum usitatissimum.* Family Linaceæ.)

A plant of Europe and America cultivated for its oil-bearing seed and fibrous stem.

### Phalonia epilinana Zell. (Conchylis.)

(Flax Capsule Worm. Family Tortricidæ; Lepidoptera.)

*Hosts:* Flax (*Linum*), *Solidago*, etc.

*Injury:* Eats out the green capsules of flax.

*Description and biology: Moth* with forewings clay yellow with darker band and margin. *Larva* whitish yellow, sparsely pubescent, head and thoracic shield blackish; 6.5 mm. long. *Pupates* in the larval burrow.

*Distribution:* South Russia.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 292.

## FORESTS.

### BETTER KNOWN GENERAL DEFOLIATORS.

Under this heading are grouped a number of important insects known as forest defoliators. Several of these have been imported into the United States.

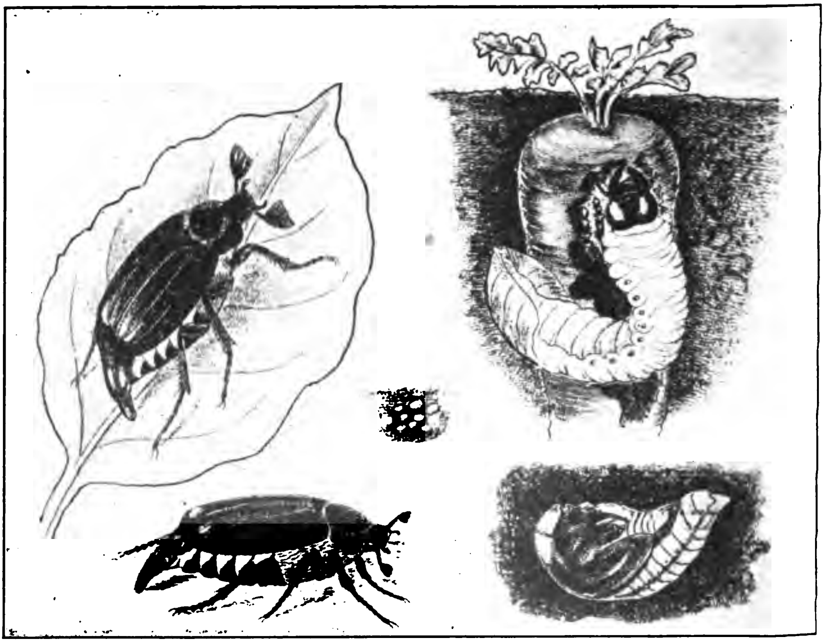


Fig. 54.—Cockchafer (*Melolontha vulgaris*); Adult, pupa, larva and its attack on root crop. (Lorenz.)

### Melolontha vulgaris Linn.

(Cockchafer. Family Scarabæidæ; Coleoptera.)

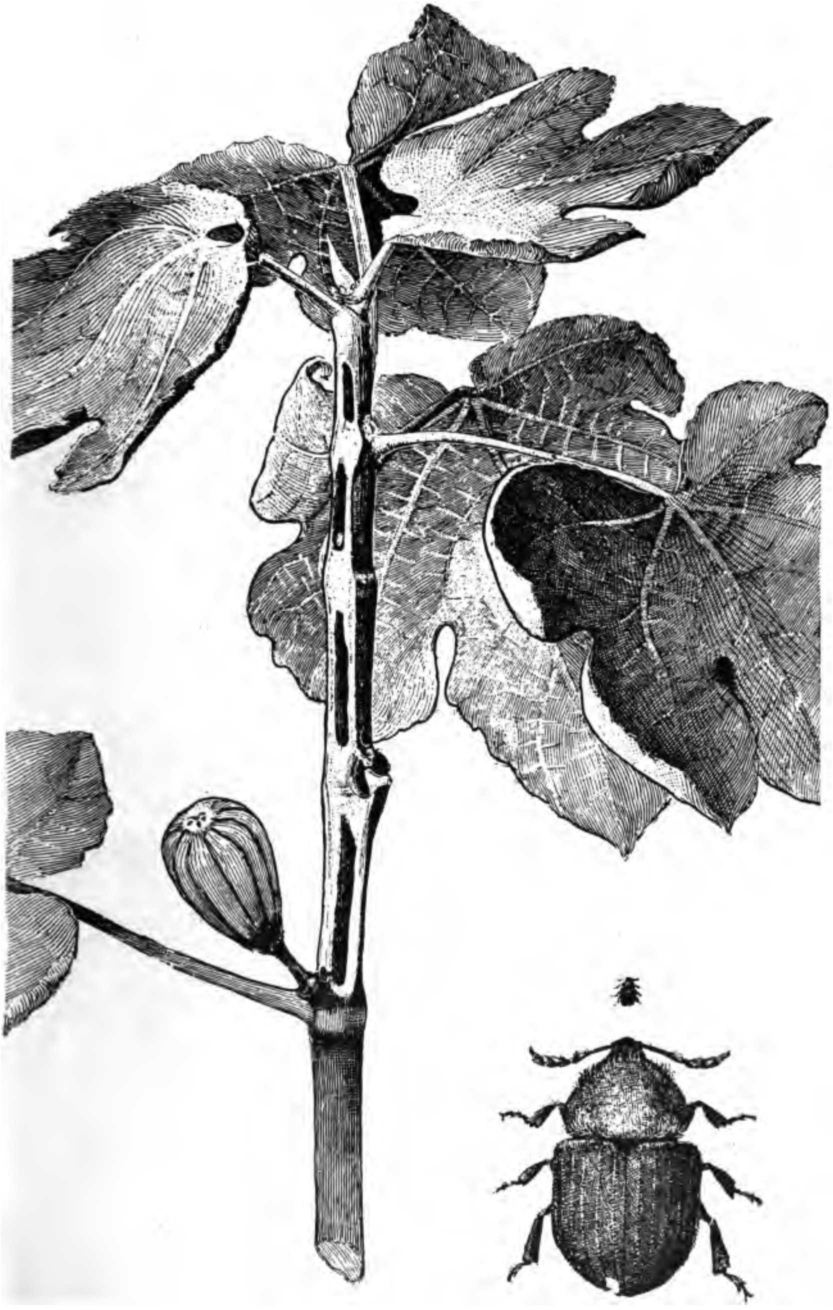
*Hosts:* Adults feed on leaves of various trees; grubs on roots.

*Injury:* Often serious.

*Description and biology: Adult*, length often 25 mm.; head and thorax black; elytra brown, each with four raised, longitudinal lines; hairy; sides of body with alternate black and white patches; occurs in May and June. *Pupa* pale brown. This stage is passed deep in ground. *Larva*, length 37 mm., white, fleshy; caudal end swollen; head and legs brown. This stage lasts three years. *Eggs*, large, shape of hemp seed, creamy white (see text fig. 54).

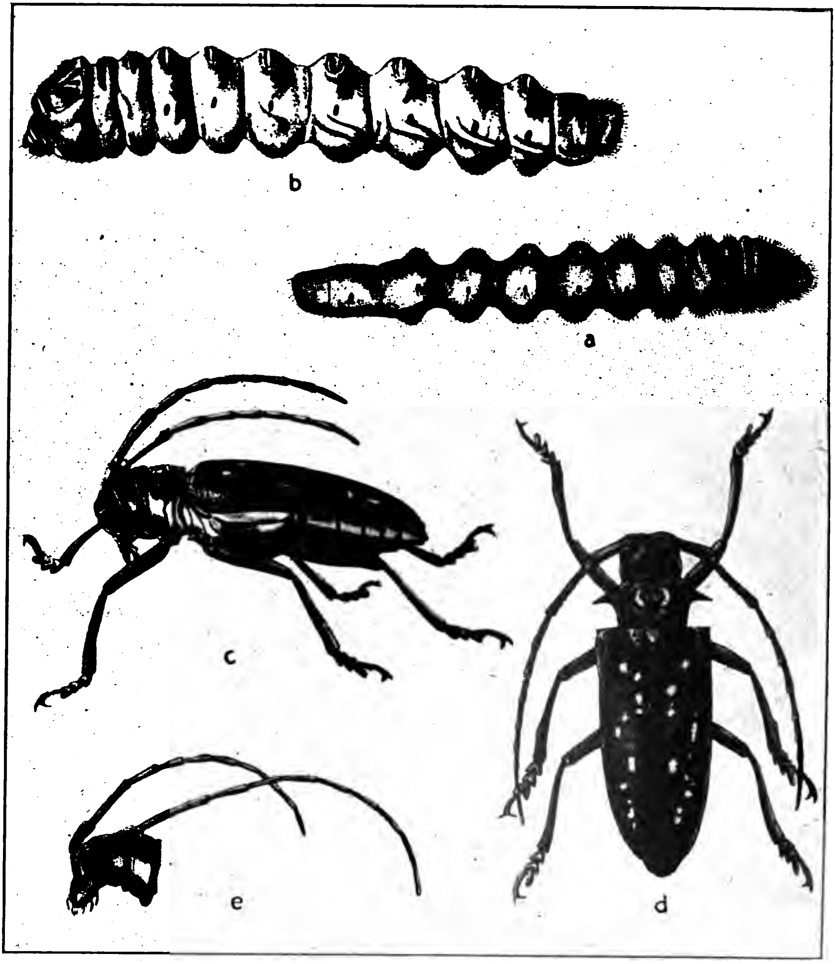
*Distribution:* Europe.

Theobald, F. V. Insect Pests of Fruit, 1909, p. 431.



A FIG BORER.

Fig-borer (*Hylesinus porcatus*): Adult and injury. (Froggatt.)



A FIG BORER.

Fig-borer (*Batocera rubra*): Adults and larvæ. (Stebbing.)

### Anisopteryx æscularia Schiffermiller.

(March Moth. Geometridæ; Lepidoptera.)

*Hosts:* Whitethorn, blackthorn, apple, plum, pear, oak, linden, elm, maple, walnut’ and chestnut.

*Injury:* Occasionally serious pest. Defoliation.

*Description and biology: Adult* male, wing expanse 30–37 mm.; forewings grayish brown, with dark and pale transverse lines, small brown spot near upper border of each wing; hind wings pale gray, dark line more or less continued from outer line on each forewing; female, wingless, grayish to grayish brown, with fan-like tail of hairs. Appears from February to April (England). *Pupates* in ground. *Larva,* length 25 mm.; bright green, or green tinged with yellow; on back, a narrow dark-green line edged with creamy white or gray; on each side three pale lines; head uniformly green; matures by end of June. *Eggs* deposited in a partial band of 50 to 200 around twig; covered with hairs; hatch in April. (See text fig. 55.)

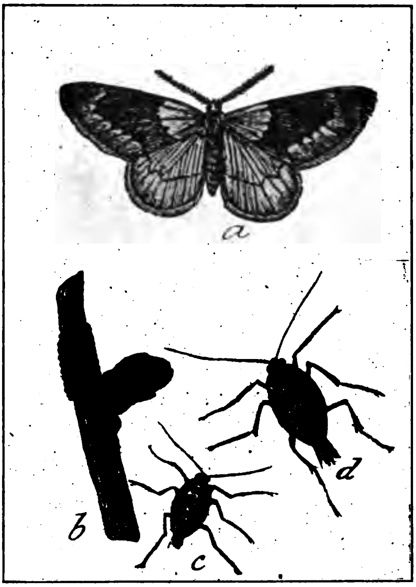


FIG. 55.—The March moth (*Anisopteryx aescularia*): a, Adult male; b, eggs on twig; c, d, female moths. (Theobald.)

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 61.

### Cheimatobia brumata Linnæus.

(Winter Moth. Geometridæ; Lepidoptera.)

*Hosts:* Fruit and forest trees (except conifers) and shrubs.

*Injury:* One of the most harmful and widespread of fruit-tree pests. Defoliation. Also attacks fruit and flowers.

*Description and biology: Adult* male, wing expanse 30 mm.; forewings grayish brown to brown, marked with darker transverse wavy lines; hind wings of paler uniform color; female practically wingless, having very short, useless, vestigial wings, gray to grayish brown in color. Moths appear from October to middle of January (England). *Larva,* length 30 mm.; pale, yellowish or dark green, with pale lines along the sides of body; in June drops to ground to form pupal cell. *Eggs* deposited on twigs, small branches, etc.; slightly elongate and truncated at ends; at first yellowish green, later brick red. (See text fig. 56.)

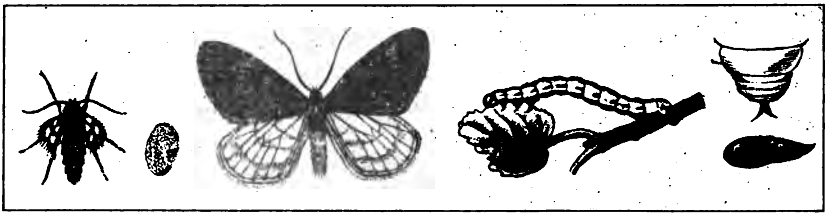


FIG. 56.—The winter moth (*Cheimatobia brumata*): Adult, larva, pupa, egg. (Lorenz.)

*Distribution:* Europe, Greenland.

THEOBALD, F. V. Insects Pests of Fruit, 1909, p. 50.

### Hibernia defoliaria Clerck.

(Mottled Umber Moth. Geometridæ; Lepidoptera.)

*Hosts:* Apple and other fruits; forest trees.

*Injury:* Great damage done occasionally by defoliation; sometimes attacks fruit.

*Description and biology: Adult* male, wing expanse 44 mm.; forewings normally pale dull yellowish, mottled with yellowish brown and dusted with brown; hind wings more uniform yellowish gray, with minute darker specks and a dark spot on each (color variable; many melanistic forms); female, wingless, plump, of various shades of yellowish gray and speckled with dark brown or black. Appears from October to February (England). *Pupates* in soil. *Larva* length 37 mm.; chestnut brown above; sides pale creamy yellow to bright yellow; venter pale yellow; spiracles pale with dark rims. *Eggs* deposited on buds and twigs, in dark crevices and on pruned surfaces, hatching in April. (See text fig. 57.)

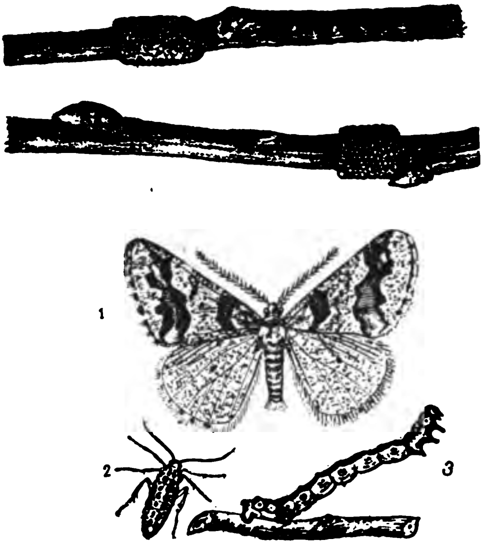


FIG. 57.—Mottled umber moth (*Hibernaria defoliaria*): Adult, larva, egg masses. (Sorauer.)

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 58.

### Malacosoma neustria Linnæus.

(Lackey Moth. Lasiocampidæ; Lepidoptera.)

*Hosts:* Fruit trees, oak, elm, hawthorn, rose, poplar, hornbeam.

*Injury:* Strips trees of foliage.

*Description and biology: Adult* male, wing expanse 25 mm., female 30–35 mm. Front wings reddish brown, ochreous or brick red with two transverse lines, pale or dusky; hind wings paler than front wings. Moth flies in July and August. (England.) *Cocoon* pale white or yellow, loose, of silk mixed with hairs. *Pupa* dark brown, stage lasting 2 or 3 weeks. *Larva* about 37 mm. long, bluish-gray in color with a pure white dorsal stripe; three orange red stripes along each side and between the two lowest of these a broad blue stripe with little black specks on it. These lines are separated by black, and black spotted with blue; a narrow dark line is on each side of the dorsal white stripe and two black spots on head and on first thoracic segment. The whole larva bears rusty hairs. Larvæ feed under tents in early stages; later they retire to tents only at nights and during dull weather. *Eggs* are deposited in rings containing from 40 to 200 each, around twigs, and hatch about end of April. (See text fig. 58.)

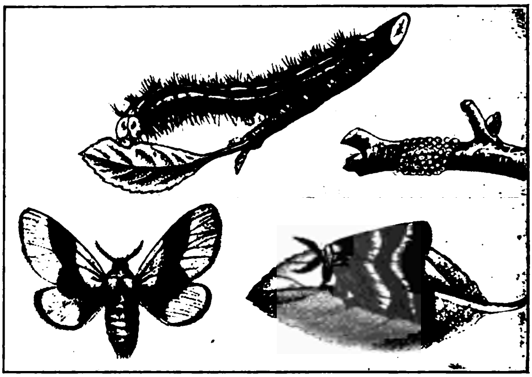
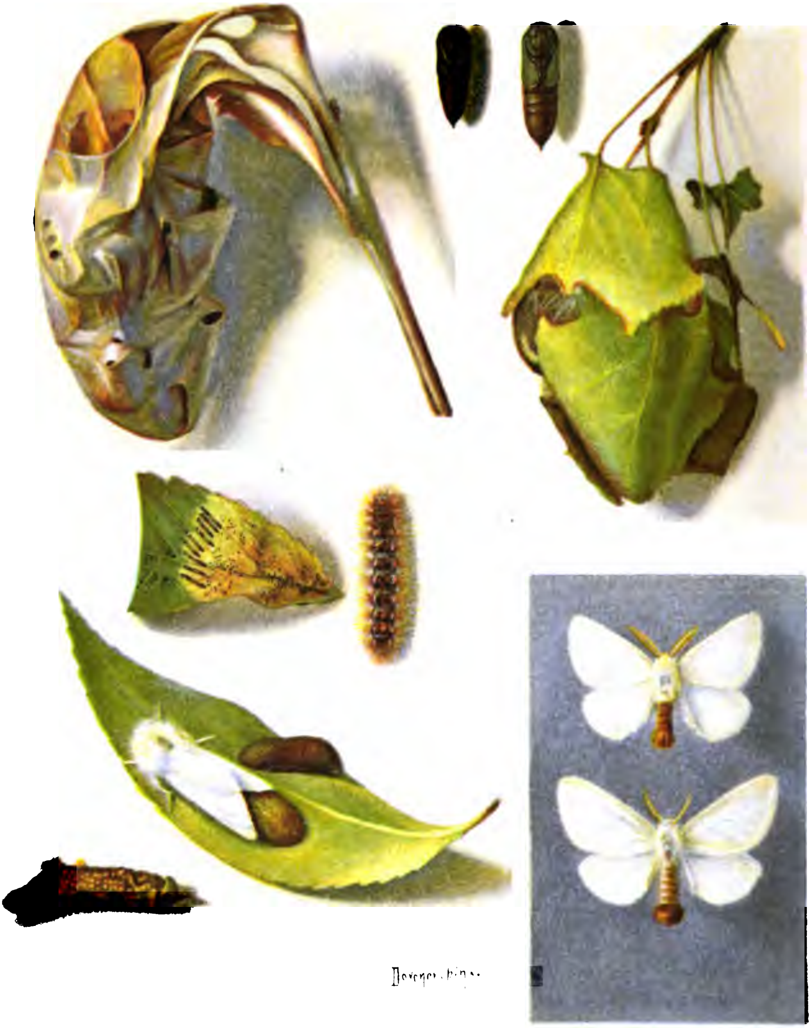


Fig. 58.—Lackey moth (*Malacocoma neustria*): Adults, larva, eggs. (Lorenz.)



DIFFERENT STAGES OF THE BROWN-TAIL MOTH (EUPROCTIS CHRYSORRHOEA).

Winter nest at upper left; male and female adults, lower right; cocoon in leaves, upper right; male and female chrysalides above, male at left; full grown larva in center, somewhat reduced; young larvæ at its left; egg mass removed from leaf, showing single eggs at lower left; female ovipositing on leaf; egg mass also on same leaf. (Howard and Fiske.)

UNIV. OF MICH.

*Distribution:* Europe, except polar region; present also in western Asia, Siberia, China, and Japan.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 30.
MONTILLOT, L. Les Insectes Nuisibles, 1891, p. 22.
NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913, p. 342.
SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 378.

### **Dasychira pudibunda** Linnæus.

(Redtail Moth. Lymantriidæ; Lepidoptera.)

*Hosts:* Beech, hornbeam, oak, alder, buckthorn, hawthorn, blackthorn, hazel, rose, birch, elm, linden, maple.

*Injury:* General defoliator.

*Description and biology: Moth* wing expanse 38–60 mm.; female larger than male; forewings whitish-gray, with two dark cross lines and dark flecked fringe; hind wings dirty gray with washed-out bar; body reddish white or grayish in front, whiter behind. *Larva* 40–45 mm. long, greenish yellow with black cross bars; yellow brushes on fourth to seventh segments; eleventh segment with a red hair pencil. Larvæ feed on foliage June to October. Pupate on ground or in brush. *Pupa* brownish black, abdomen reddish brown, clothed with yellow hairs, in silken cocoon. Hibernates as pupa. *Eggs* in clusters of 50 or more on twigs.

*Distribution:* Europe, China, Japan.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 384.
HESS, RICHARD. Der Forstschutz, vol. 2, 1900, p. 91–97, fig. 57.
GUÉNAUX, G. Entomologie et Parasitologie Agricoles, 1904, p. 392.
HENSCHEL, G. A. O. Die schädlichen Forst- und Obstbaum-Insekten, 1895, p. 329.

### * **Euproctis chrysorrhoea** Linnæus.

(Brown-tail Moth. Lymantriidæ; Lepidoptera.)

*Hosts:* Beech, elm, hornbeam, maple, oak, poplar, blackthorn, hawthorn, rose, willow.

*Injury:* General defoliator; very serious.

*Description and injury: Moth,* white, posterior part of body reddish brown; wing expanse 30–35 mm. *Larvæ* 30–38 mm. long, brownish gray, with light brown hairs. The larvæ feed on foliage under heavy white webs. (See plate XXII.)

*Distribution:* Palæarctic regions (Europe, Asia). Has been introduced into the northeastern United States.

ANNUAL REPORTS STATE FORESTER OF MASSACHUSETTS.

### * **Porthetria dispar** Linnæus (**Lymantria**).

(Gipsy Moth. Lymantriidæ; Lepidoptera.)

*Hosts:* Beech, elm, hornbeam, linden, maple, oak, poplar, willow, alder, birch.

*Injury:* General defoliator. Easily transported in egg stage on bark of nursery stock. A very serious pest.

*Description and biology: Male,* moth 35–50 mm.; forewings gray brown with dark brown, strongly notched transverse stripes and dark flecks on fringe; hind wings brown, with dark border and light fringe. *Female,* moth 37–62 mm., wings white with dark fringe spots; the dark transverse stripes in outer part of forewings often disappearing. *Larva* with large head; brown, hairy; three fine yellow longitudinal lines; the first five segments with two blue warts each and on the remaining segments two red warts each; length 7 cm. (See Frontispiece.)

*Distribution:* Europe, Asia, New England States.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 380–382.
FORBUSH, E. H., and FERNALD, C. H. The Gypsy Moth, Mass., St. Bd. Agric., 1896, 495 pp.

### * Lymantria monacha Linnæus.

(Nun Moth. Lymantriidæ; Lepidoptera.)

*Hosts:* Beech, birch, elm, poplar, oak, maple, linden, hazel, willow, pine, spruce, mountain ash, buckthorn, bunch cherry, spindle tree, hornbeam, larch, white spruce.

*Injury:* Attacks the foliage of many trees and is sometimes very serious. As the eggs are said to be laid under the bark, it is very likely to be shipped in nursery stock.

*Description and biology: Moth,* with forewings white, with strong notched black lines; hind wings grayish white; fringe flecked with black; abdomen reddish with black bands. *Larvæ* brown with six blue and red warts on dorsum; on second segment a black, blue, and white spot; three last segments flecked with black; 4–5 cm. long. The species is quite variable in color. The larva is polyphagous, attacking foliage; the larvæ are gregarious and feed within a web.

*Distribution:* Europe. Specimens were collected at Brooklyn, N. Y., in 1902.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 379–380.

Nüsslin, Otto. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 346–368, figs. 291–298.

### Porthesia similis Fuessly.

(The Swan Moth. Lymantriidæ; Lepidoptera.)

*Hosts:* Beech, birch, elm, hornbeam, linden, mountain ash, maple, oak, willow, rose.

*Injury:* General defoliator. Liable to importation in the larval stage on the bark of nursery stock.

*Description and biology: Moth,* white with a few black spots on inner margin of forewing; abdomen clad with golden yellow hairs. *Larva* black, clothed with grayish-black hairs. The larvæ feed singly on foliage and hibernate singly under bark, etc. The *eggs* are laid in a mass on undersides of leaves and covered with yellow hairs from the moth. *Pupation* occurs in a thin white silken cocoon.

Hess, Richard. Der Forstschutz, vol. 2, 1900, pp. 102, 103.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 382.

### Phalera bucephala Linnæus.

(Buff Tip Moth; Moon Spot Moth. Notodontidæ; Lepidoptera.)

*Hosts:* Deciduous fruits; cobs, filberts, nuts, birch, beech, elm, rose, poplar, willow, linden, oak, alder.

*Injury:* Defoliates plants when abundant.

*Description and biology: Adult,* wing expanse 62–70 mm.; forewings ash gray with a transverse streak of reddish brown near base and another of dark brown near apex of wing, marked at tip with a large pale buff or ochraceous lunular spot. *Larva* about 50 mm. long when grown; the ground color dark yellow, with a broad dark stripe down the back; along each side are three black lines interrupted with yellow or orange rings. *Eggs* very convex, flat beneath, pearly white, with a basal green band and dark spot on apex. The insect spends the winter as a pupa in the soil, moths appearing in spring, ovipositing on undersurface of twigs or on foliage.

*Distribution:* Europe, except Polar region, Siberia, etc.

Theobald, F. V. Insect Pests of Fruit, 1909, p. 292.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 387, fig. 245.

Nüsslin, Otto. Leitfaden der Forstinsektenkunde, 1913, 2d ed., 1913, pp. 323, 324, fig. 276.

## FRUITS.

### BETTER KNOWN GENERAL FRUIT-TREE INSECTS.

Under this heading are grouped a number of very important insects which attack many different kinds of fruits, especially the fruit flies.

### **Aleurodicus cocois Curtis.**

(Coconut White Fly. Aleyrodidæ; Hemiptera.)

*Host:* Coconut, banana, guava, "jicaco," *Coccoloba uvifera.*

*Injury:* Serious pest in many parts of tropical America.

*Description and biology: Adult* varying in size and wing markings, wings marked with two dusky patches; pupal case varies in size and is surrounded by a double row of bristlelike hairs usually 13 to a side, also has one pair of long caudal hairs. *Egg* about 0.29 mm. long and 0.11 mm. wide, with pedicel arising from side.

*Distribution:* Barbados, Trinidad, Venezuela, Brazil, Mexico, Isthmian Canal Zone, Yucatan.

BALLOU, H. A. Insect Pests of the Lesser Antilles, 1912, p. 105.

### **Nysius vinitor Bergroth.**

(The Rutherglen Bug. Lygæidæ; Hemiptera.)

*Hosts:* Grapes, cherries, plums, peach, grasses, etc.

*Injury:* Stated to be one of the most destructive plant bugs in Australia.

*Description and biology: Adult* 4–5 mm. long; dull brown to gray in color, with silvery-gray wings; antennæ barely two-thirds length of body and covered with hairs. Breeds in grass lands and swarms over field crops and fruit trees in countless millions.

*Distribution:* Australia. (See plate XXIII.)

FRENCH, C. Handbook of Destructive Insects of Victoria, 1891, pt. 1, p. 105.

FROGGATT, W. W. Australian Insects, 1907, p. 334.

### * **Heliothrips rubrocinctus Giard.**

(The Red-Banded Thrips. Thysanoptera.)

*Hosts:* Avocado (*Persea gratissima*), mango (*Mangifera indica*), cashew, guava (*Psidium guajava*), cacao (*Theobroma cacao*), Liberian coffee (*Coffea liberica*), wild guava (*Anacardium occidentale*), roses, Mexican almond or umbrella tree (*Terminalia catappa*), kola (*Sterculia acuminata*).

*Injury:* Larvæ and adults feed on both surfaces of foliage. May be introduced on living plants.

*Description and biology: Egg stage* varies from 6 to 17 days, larval stage from 6 to 20 days. *Adult* female about 1.11 mm. long and quite stout, color dark brown or black. A red band is evident in the first and second larval stages, pupa and prepupa. (See pl. X.)

*Distribution:* Guadeloupe, French West Indies; Grenada, St. Vincent, St. Lucia, British West Indies; Trinidad, Tobago, Virgin Islands, Mauritius, Ceylon, Uganda. In addition to the above it is reported from Florida and was doubtless introduced.

RUSSELL, H. M. U. S. Dept. Agr., Bur. Entom. Bull. 99, pt. 2, 1912.

### **Phyllopertha horticola Linnæus.**

(Scarabæidæ; Coleoptera.)

*Hosts:* Fruit trees and herbaceous plants.

*Injury:* Destroys foliage and roots.

*Description and biology: Adult* length 8–11 mm.; body depressed, hairy; head and prothorax shining green; elytra golden brown or chestnut; ventral parts black. Appears in May and June (Italy). Feeds on leaves. The *larva* is a root feeder. Silvestri states that the adults and larvæ of this insect feed on leaves and roots of fruit trees and herbaceous plants.

*Distribution:* Europe.

SILVESTRI, F. Dispense di Entomologie Agraria, 1911, p. 311.

### Capnodis tenebrionis Linnæus.

(Buprestidæ; Coleoptera.)

*Hosts:* Various fruit trees.

*Injury:* To leaves and roots.

*Description and biology: Adult* length 15–22 mm.; color opaque black, with prothorax sparsely dusted with cinereous; feeds on leaves. *Larva* elongate, whitish, covered with a fine pubescence; feeds in roots and trunk beneath cortex. *Eggs* deposited during August and September on crown of trees. (See text fig. 59.)

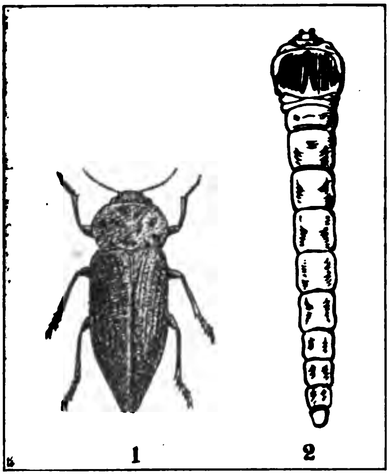


FIG. 59.—Fruit tree borer (*Capnodis tenebrionis*): Adult, larva. (Silvestri.)

*Distribution:* Southern Europe.

SILVESTRI, F. Dispense di Entomologie Agraria, 1911, p. 335.

### Phyllobius oblongus Linnæus.

(Oblong Leaf Weevil. Brachyrhinidæ; Coleoptera.)

*Hosts:* Fruit trees, bushes.

*Injury:* Frequent. Adults attack young buds and leaves. Larvæ feed on roots of various plants.

*Description and biology: Adult* length 4–5 mm.; black; elytra covered with brown scales with reddish tinge or pale gray, borders dark; head, thorax, and elytra covered with gray pubescence; legs brown or yellowish. Occurs throughout May and June. *Pupates* in spring in earth. *Larva* a white footless grub, slightly hairy; head brown. Winters as larva. *Eggs* are deposited in ground.

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruits, 1909, p. 119.

### Biston hirtarius Clerck.

(Cherry Spinner. Geometridæ; Lepidoptera.)

*Hosts:* Stone fruits, orchard trees.

*Injury:* Defoliation.

*Description and biology: Adult* in both sexes winged; whitish, dusted with blackish gray and obliquely marked with blackish brown. Occurs in March and April (Germany). *Pupates* in the earth. *Larva*, length 35 mm.; ash gray or brown in color, with longitudinal dark lines; prothorax, tubercles and two spots on each segment yellow; occurs from May until September. (See text fig. 60.)

*Distribution:* Germany, northern Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 339.

### Biston pomonarius Hübner.

(Geometridæ; Lepidoptera.)

*Hosts:* Fruit trees and oaks.

*Injury:* Defoliation.

*Description and biology: Adult,* male wings grayish white, on border blackish, dusted with gold, with dark oblique lines; female, with wing stumps black, sprinkled with red and with gray and white hairs. Occurs in April and May (Germany). *Pupates* in the earth. *Larva*, length 40 mm.; gray, with golden, longitudinal lines; occurs May to July.

*Distribution:* Northern Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 339.

### **Hibernia rupicapraria** Hübner.

(Early Moth. Geometridæ; Lepidoptera.)

*Hosts:* Plum, thorns, fruit trees.

*Injury:* "No record of serious damage." (Theobald.)

*Description and biology: Adult* male wing expanse 30 mm.; forewings gray brown, with broad dark area across middle, edges dark and notched; hind wings whitish gray, with a dark central spot above middle and crossed by an indistinct gray streak; female, almost wingless, stumps of wings grayish; occurs in January and February (England). *Larva* bluish green with pale green back, front of each segment darkened, and a white line on each side; *pupates* in soil.

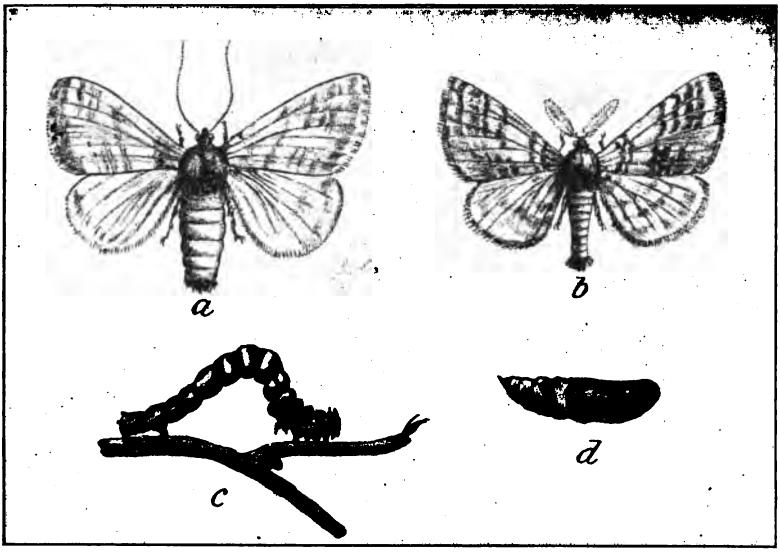


FIG. 60.—Cherry spinner (*Biston hirtarius*): *a*, Adult; female; *b*, adult male; *c*, larva; *d*, pupa. (Sorauer.)

*Distribution;* England, Europe (except Russia), Asia Minor.

THEOBALD, F. V. Insect Pests of Fruits, 1909, p. 362.

### **Gastropacha quercifolia** Linnæus.

(Lappet Moth. Lasiocampidæ; Lepidoptera.)

*Hosts:* Apple, plum, pear, hawthorn, blackthorn, willow, sallow.

*Injury:* Can not be looked upon as a pest. Sometimes strips branches and shoots.

*Description and biology: Adult* male wing expanse 56 mm.; female, 80 mm.; color rich brown, with dark irregular, transverse, scalloped lines on both pairs of wings, edges of wings scalloped. Moths appear in June and July (England). *Pupa* large brown motile; cocoon spun among twigs of trees, crevices, in bark and rubbish on ground; oval, pointed at one end and mouse-colored. *Larva* 100 mm. long; gray and gray brown, with faint V-shaped dark marks dorsally; two deep blue or purple bands across first thoracic segment; above legs on each side is a row of fleshy pad-like appendages with long gray hairs like "lappets"; body finely hairy. Larvæ appear in autumn and hibernate, extended on twigs.

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruits, 1909, p. 19.

### **Odonestis pruni** Linnæus.

(Lasiocampidæ; Lepidoptera.)

*Hosts:* Various fruit trees.

*Injury:* Defoliation.

*Description and biology: Adult* length of wing 20–30 mm.; forewing orange, strongly dusted with red, with sharp points and a notched margin; a single white spot in the middle; front diagonal lines arched, hind diagonal line straight, body and hindwing brick red. Occurs June and July (Germany); *pupates* in May (Germany) in grayish-white cocoon. *Larva* length 65–70 mm.; blue gray, with golden longitudinal lines, and dull golden-gray spots; head brownish gray; hatches in August; overwinters and feeds in spring until May (Germany). *Eggs* deposited singly.

*Distribution:* Europe.

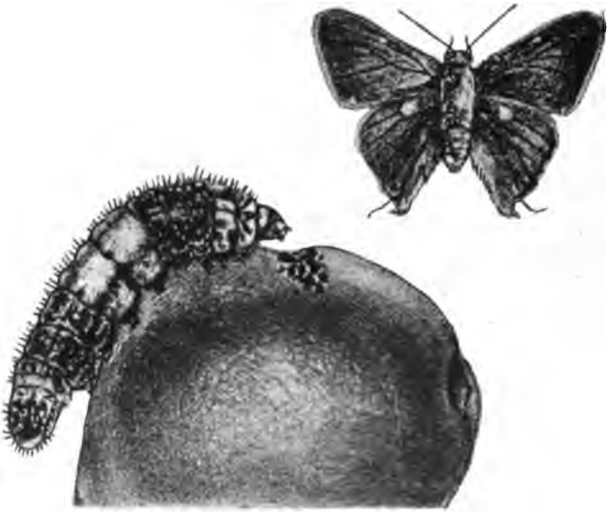


FIG. 61.—The Amar caterpillar (*Virachola insocrates*): Adult and larva. (Maxwell-Lefroy.)

HENSCHEL, G. A. O. Die Schädlichen Forst und Obstbaum-Insekten, 1895, p. 315.

### **Virachola insocrates** Fabricius.

(The Amar Caterpillar. Lycænidæ; Lepidoptera.)

*Hosts:* Pomegranate, guava, loquat, and wild fruit.

*Injury:* Larvæ occasion considerable injury by feeding in the fruit.

*Biology: Eggs* deposited singly on flowers; *caterpillar* on hatching bores into the fruit, feeding on the hard seed; *pupates* over the base of fruit. (See text fig. 61.)

*Distribution:* India.

MAXWELL-LEFROY, H. Indian Insect Pests, 1906, p. 179.

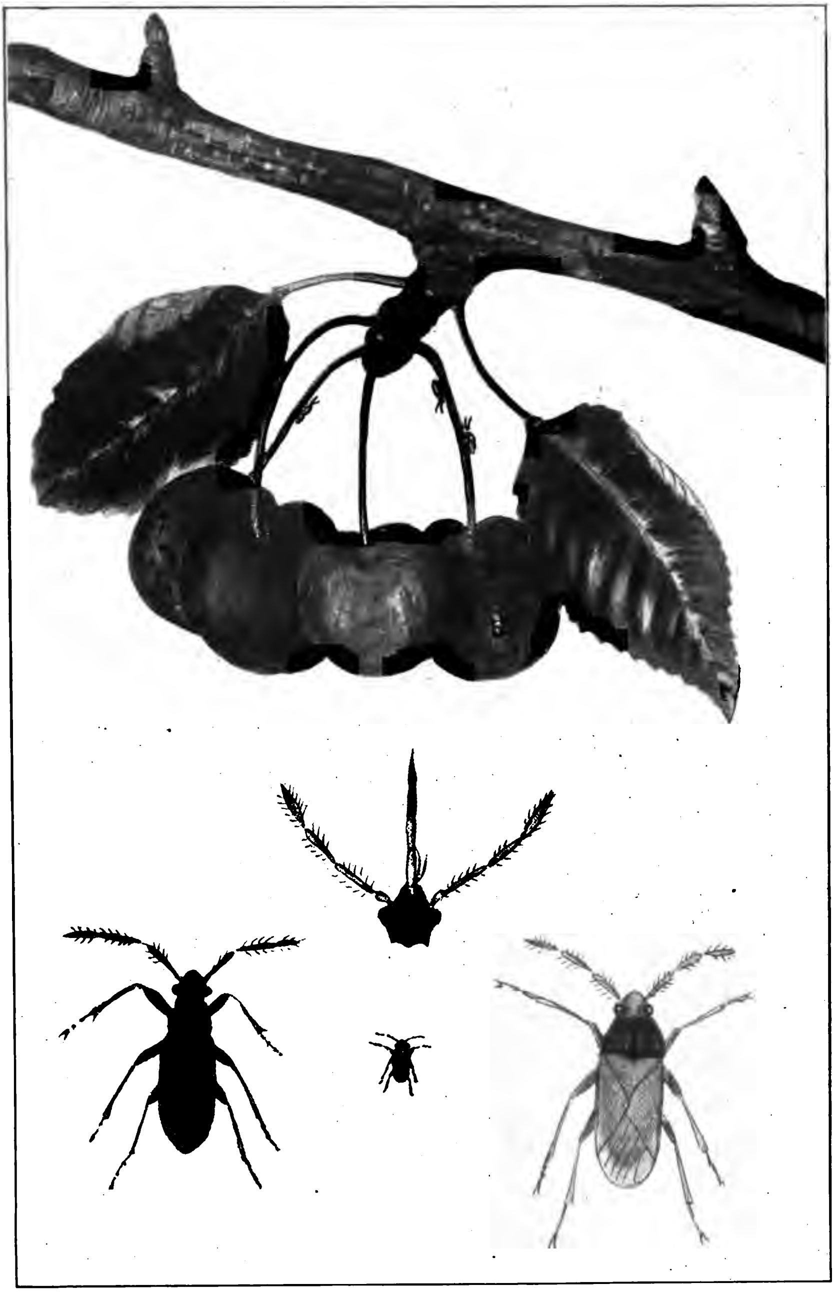
### **Orgyia gonostigma** Fabricius.

(Brush Spinner; Corner spot. Lymantriidæ; Lepidoptera.)

*Hosts:* Orchard and other trees.

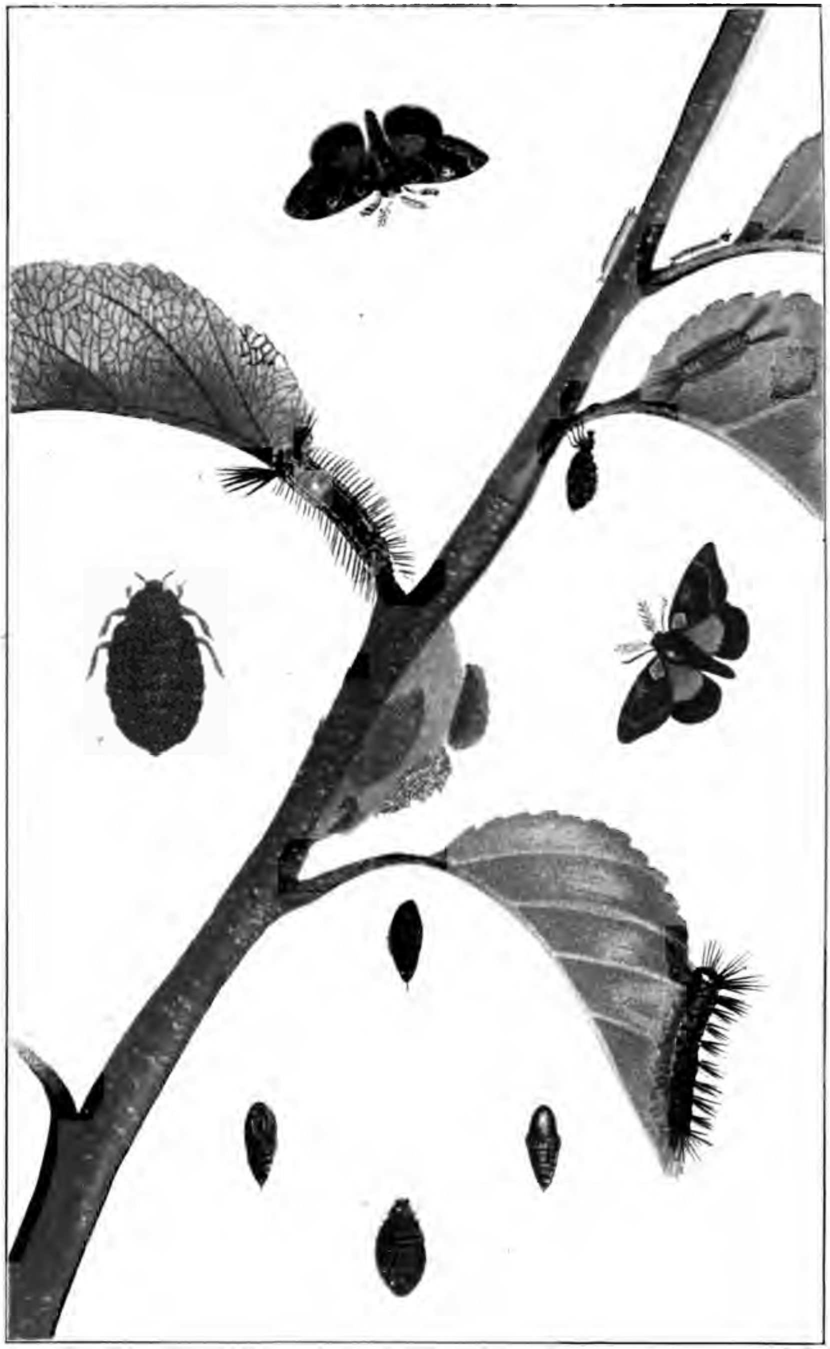
*Injury:* Defoliation.

*Description and biology: Adult* male, forewing 13–15 mm.; olive brown with white spots, on the front and inner margins toward the base long orange wavy lines, basal portion, and a spot on the oblique vein, purple brown, fringe between veins black spotted; hind wing brownish black. First generation June and July, second, September (Germany). *Pupates* between leaves and in crevices. *Larva* of male, 52 mm.



A CHERRY PEST.

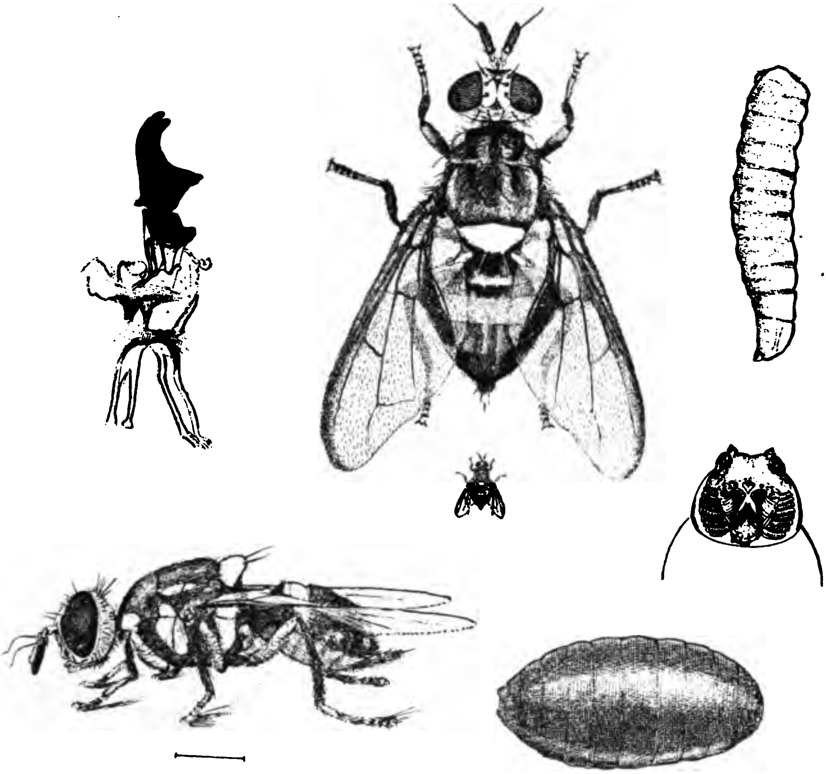
The Rutherglen bug (*Nysius vinitor*): Adults and injuries to cherries. (French.)



THE PAINTED APPLE MOTH.

The painted apple moth (*Teia anartoides*): Adults, larvæ, pupæ, eggs. (French.)

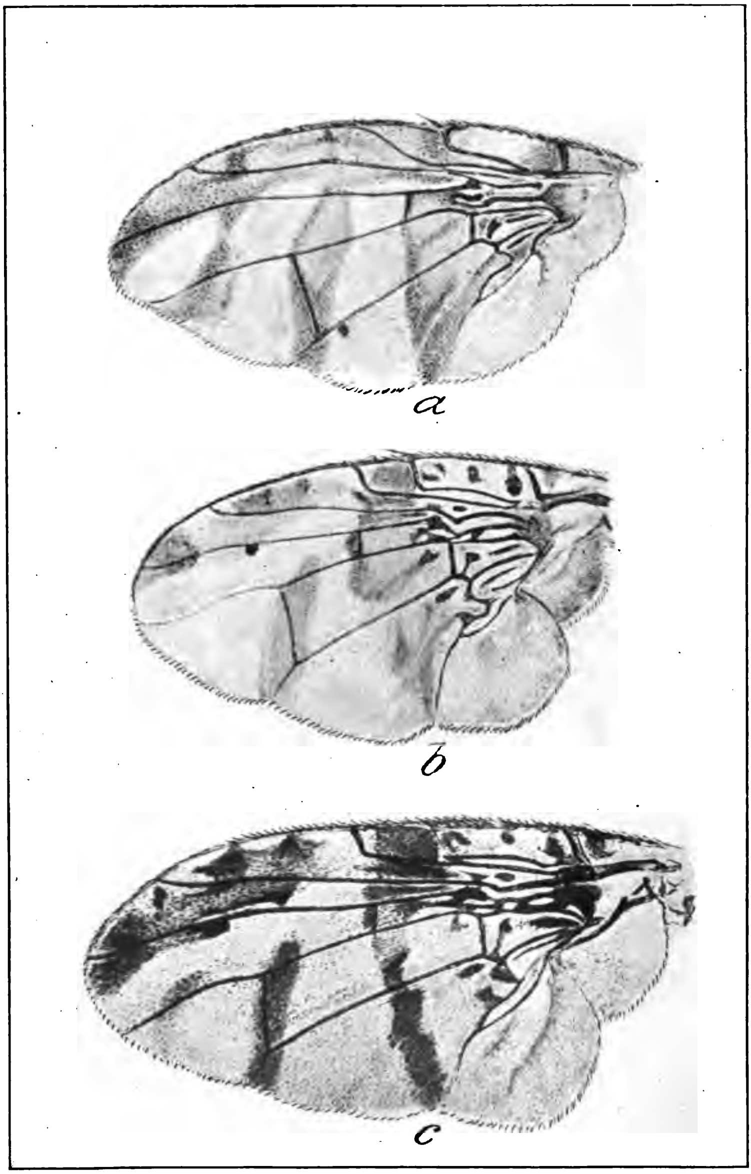
UNIV. OF



THE QUEENSLAND FRUIT FLY.

The Queensland fruit fly (*Bactrocera tryoni*): Adults, larva, puparium. (Froggatt.)

UNIV. OF MICH.



WINGS OF FRUIT FLIES.

FIG. a.—*Ceratitis striata.* FIG. b.—*Ceratitis capitata.* FIG. c.—*Ceratitis rubivora.* (Froggatt.)

long, of female 30 mm.; black striped with reddish gold; four pair of dorsal brushes, golden brown; pencils black, adorned with long variable hairs; warts white covered with golden hair; head grayish black with red collar; spring and summer broods. *Eggs* deposited in mass near pupal exuvium; overwinter.

*Distribution:* Europe.

HENSCHEL, G. A. O. Die Schädlichen Forst und Obstbaum-Insekten, 1895, p. 326.

### **Teia anartoides** Walker.

(Painted Apple Moth. Lymantriidæ; Lepidoptera.)

*Hosts:* Fruits, particularly apple, cherry, rose, acacia. Almost omnivorous.

*Injury:* One of most injurious caterpillars of New South Wales. Eats upper surface of leaves. "Strips trees." (French.)

*Description and biology: Adult* female, short, rounded, wingless; male, wing expanse 25 mm.; fore wings dark brown marbled with slender lines and black spots; hind wings yellow surrounded with black outer margin; antennæ featherlike. Two broods. *Pupa* in loose brown silken cocoon of flimsy character. Winters as pupa. *Larva,* 44 mm. long, brown, hairy, with tufts of hairs standing out at front and sides of head and stiff brushes of gray hairs along center of back. *Egg,* dull white, hemispherical. Females average 700 eggs, deposited in the cocoon. (See plate XXIV.)

*Distribution:* New South Wales, Victoria.

FRENCH, C. Handbook of Destructive Insects of Victoria, 1900, pt. 3, p. 94.

### **Olethreutes cynobatella** Linnæus.

(Gray Fruit Tree Bud Moth. Tortricidæ; Lepidoptera.)

*Host:* Various fruit trees.

*Injury:* Attacks leaf and blossom buds.

*Description and biology: Adult,* fore wing 7.5–10.5 mm.; from the middle of the front margin to the inner angle dark bluish-gray mixed with brown; behind the middle, two variable, distinct dark spots on an entirely white background; the large apical third white, clouded with gray. On wing, June until August (Germany). *Pupates* in grass or in crumpled leaves, drawn together, during May and June. *Larva,* brownish green; bores in the opening leaf and flower buds, the points of which it spins together; occurs in spring from time of swelling of buds until May (Germany). *Eggs* are deposited singly on buds; overwinter.

*Distribution:* Germany, Europe.

HENSCHEL, G. A. O. Die Schädlichen Forst und Obstbaum-Insekten, 1895, p. 417.

### **Anastrepha fraterculus** Wiedemann (**acidusa** Walker).

(Fruit Fly. Trypetidæ; Diptera.)

*Hosts:* Guava, (*Psidium guajava*), coffee berries, pear, peach, mango, orange, *Eugenia* spp., *Phylocalyx,* Japanese plum, Japanese persimmon, Para plum (*Spondias* spp.?), *Annona humboldtiana,* jobo amarillo, jobo de la India.

*Injury:* A very destructive species and likely to be introduced.

*Description and biology: Adult* fly, about 12 mm. in length (the female exclusive of the ovipositor), with a wing expanse slightly over 25 mm. Color of body rust-yellow or brownish yellow, with three sulphur-yellow longitudinal stripes on the thorax in well preserved mature specimens. Wings clear tinted in part with a characteristic pattern of yellow brown, the brown predominating on the basal half and extending obliquely forward, being continued along the anterior margin in a broad streak to the extreme tip of the wing; a clear sinuate basal zone involves the second basal cell, the base of the discal and part of the first basal cell, and is followed by a detached spot at the costa just beyond the tip of the first vein; on the discal half of the wing there is a brown band in the shape of an inverted V, resting on the posterior margin and extending through the first and second posterior cells; this V-shaped mark may be independent, or its apex may be joined to the other brown zone. There is considerable variation in the wing pattern, both as to intensity of coloring and detail of the pattern. Immature specimens have the brown wing pattern much weaker; newly emerged ones show hardly a trace of it. Female ovipositor stout, shorter than abdomen, tapered regularly toward tip and covered with coarse black hairs; in mature specimens it is subcylindrical, but in specimens not fully hardened it is flattened.

*Distribution:* Mexico, Central and South America, West Indies.

Von Ihering, H. Revista Agric. (Sao Paulo), 1901, vol. 6, No. 70, p. 180.
Howard, L. O. U. S. Dept. Agric., Yearbook 1897, p. 546.
Hooker, C. W. Ann. Rept. Porto Rico Agric. Exp. Sta., 1912, p. 36.

### Anastrepha ludens Loew.

(Mexican Fruit Fly. Trypetidæ; Diptera.)

*Host:* Orange, sweet lime, mango, *Sideroxylon* (*Achras*) *sapota*, peach, guava, plum.

*Injury:* Considered a serious pest in Mexico. Quarantine issued January 15, 1913.

*Description and biology: Adult* female, length 9 mm.; of dull ochreous yellow color; wings hyaline, mottled and striped with brownish yellow bands; anal segment of abdomen longer than remainder of abdominal segments combined. *Eggs* deposited under skin of ripening fruit, larvæ on hatching out tunnel into the fruit; *pupate* in soil. Average life cycle about 3 months, making about four generations a year in Mexico.

*Distribution:* Mexico.

Froggatt, W. W. Department of Agric., New South Wales, Farmers' Bull. 24, 1909, p. 53.

### Anastrepha peruviana Townsend.

Peruvian Fruit Fly. Trypetidæ; Diptera.)

*Hosts:* Peach, guava, cherimoya, many other deciduous and citrous fruits.

*Injury:* Very serious in Peru.

*Description: Female fly*, to tip of ovipositor, 7–8 mm. long; male 6.5–7 mm. long; wing expanse 6–6.5 mm. Color of head, pleuræ, anterior half of venter, and legs watery lemon yellow; antennæ and proboscis buff yellow; tibiæ and tarsi slightly dusky: mesopleural and sternopleural plates largely rufous-yellow tinged; eyes bright green to lilac purple; other parts obscure tawny or yellow.

*Distribution:* Peru.

Townsend, C. H. T. Journ. Econ. Entom., 1913, vol. 6, No. 4, p. 345.

### Bactrocera tryoni Froggat.

(Queensland Fruit Fly. Trypetidæ; Diptera.)

*Host:* Banana, mango, peach, apricot, nectarine, orange, apple, quince, black apple (*Sideroxylon* [*Achras*] *australe*), cheesewood (*Acronychia lævis*), white ash (*Schizomeria ovata*), cucumbers, loquats.

*Description and biology: Adult* female, 6 mm. long with wing expanse 10–12 mm., wings transparent, abdomen constricted at the base and broadly rounded at the tip, thorax with a broad creamy often pale dorsal band running down the scutellum with short, well-defined narrow pale yellow stripe on each side. (See plate xxv.)

*Distribution:* India, Ceylon, Java, Amboina, Australia (Queensland, New South Wales).

Froggatt, W. W. Dept. Agric., New South Wales, Miscl. Pub. No. 303, 1899, p. 2, figures.
Froggatt, W. W. Dept. of Agric. New South Wales, Farmers' Bul. 24, 1909, p. 11.

### Ceratitis anonæ Graham.

(Annona Fruit Fly. Trypetidæ; Diptera.)

*Hosts:* Sour sop (*Annona muricata*), guava (*Psidium cattleianum*), and cacao pods.

*Injury:* Attacks fruit.

*Description: Adult* female, head alutaceous, wings with black spots at the base, abdomen nut brown in color on dorsum, antennæ almost twice as long as wide; length of body 6 mm.

*Distribution:* West Africa (Nigeria, Kongo, Ashanti, Armani, German East Africa).

Silvestri, F. Boll. Lab. Zool. R. Sc. Agric., Portici, 1913, vol. 8, p. 61.
Silvestri, F. Bd. Agric. and Forestry, Terr. Hawaii, Div. Ent., Bul. 3, 1914, p. 66.

### Ceratitis capitata Wiedemann.

(The Mediterranean Fruit Fly. Trypetidæ; Diptera.)

*Hosts: Aberia caffra* (kei apple), *Sideroxylon sapota* (sapodilla), *Annona muricata* (sour sop), *Atropa belladonna, Averrhoa carambola, Calophyllum inophyllum* (round kamani), *Capsicum* sp., *Carica papaya, C. quercifolia, Carissa arduina* (Natal plum), *Cestrum* sp. (Chinese inkberry), *Chrysobalanus ellipticus, C. icaco* (cocoa plum), *Chrysophyllum cainito* (star apple), *Citrus aurantium* (orange and varieties), *C. grandis* (grapefruit), *C. japonica* (kumquat and Chinese orange), *C. limonia* (lemon), *C. nobilis* (mandarin orange), *Coffea arabica* (coffee), *Diospyros kaki* (Japanese persimmon), *Eriobotrya japonica* (loquat), *Eugenia braziliensis* (Brazil cherry), *Eugenia jambos* (rose apple), *E. malaccensis* (mountain or Malay apple), *E. uniflora* (Cayenne or Surinam cherry), *Ficus carica* (fig), *Herpephyllum caffrum* (Kaffir plum), *Lycopersicum esculentum* (tomato), *Mammea americana* (mammee apple), *Mangifera indica* (mango), *Mimusops elengi* (elengi tree), *Murraya exotica* (mock orange), *Musa* spp. (banana), *Noronhia emarginata* (Chinese plum), *Opuntia tuna* (prickly pear), *O. vulgaris* (Barbary fig), *Passiflora quadrangularis* (granadilla), *Persea gratissima* (avocado), *Phaseolus vulgaris* (string beans), *Prunus armeniaca* (apricot), *P. cerasus* (sour cherry), *Amygdalus persica* (peach), *Psidium cattleianum* (strawberry guava) *P. guajava* (guava), *Pyrus communis* (pear), *Cydonia oblonga* (quince), *Mespilus germanica* (medlar) *Malus malus* (apple), *Solanum capsicastrum* (Jerusalem cherry), *Terminalia catappa* (winged kamani), *T. chebula, Thevetia neriifolia, Vitis vinifera* (grapes).

*Injury:* Very injurious wherever it becomes established.

*Description and biology:* Egg deposited inside of fruit by female, and requires from 2 to 3 days to hatch; the larva upon hatching feeds on the pulp or inside of the fruit until full grown, requiring from 9 to 12 days, whereupon it leaves the fruit and enters the ground to pupate, which stage ranges from 12 to 20 days. The period required for the various stages is influenced by the season, as indicated by Silvestri, requiring from 21 to 23 days to complete the life cycle in August and from 32 to 35 in October. At Honolulu adults have been kept alive for 10 months and certain individuals have required 90 days for development. (See pl. xxvi, fig. *b*.)

*Distribution:* Southern Europe (southern Italy, Sicily, Malta, France, Spain), Azores, Cape Verde Islands, Madeira, Africa (northern Uganda, Delagoa, Transvaal, Cape Colony, Kongo, Nigeria, Dahomey), Brazil, Argentina, Bermuda, Australia, (West Australia, New South Wales, northern Victoria, and Queensland), northern New Zealand, Hawaiian Islands, Jamaica, Cape of Good Hope.

Quaintance, A. L. U. S. Dept. Agr., Bur. Entom. Circ. 160, 1912.
Silvestri, F. Bd. Agric. and Forestry, Terr. Hawaii, Div. Entom. Bull. 3.

### **Ceratitis nigerrima** Bezzi.

(Nigeria Fruit Fly. Trypetidæ; Diptera.)

*Hosts:* Coffee berries, fruit of wild plant (?), *Eugenia uniflora*.

*Injury:* Breeds in fruit.

*Description: Adult* female with black polished body, head umber, wings colored with brown, tibiæ and tarsi dirty yellowish white, ovipositor slightly recurved.

*Distribution:* Southern Nigeria, Kamerun.

Silvestri, F. Bd. Agric. and Forestry, Terr. Hawaii, Div. Entom., Bul. 3, 1914, p. 72.

### **Ceratitis giffardi** Bezzi.

(Giffard Fruit Fly. Trypetidæ; Diptera.)

*Hosts: Chrysobalanus ellipticus*, *Sarcocephalus esculentus*.

*Injury:* Larvæ feed in fruit of *Sarcocephalus* and less so in *Chrysobalanus*.

*Description and biology: Adult* female, body ochraceous, thorax marked with black, wings with black lines and markings at base, bearing also yellowish and brown bands. Transformation to the pupa takes place in the soil, requiring from 10 to 12 days before emerging as adult.

*Distribution:* Senegal, Dahomey, southern Nigeria.

Bezzi, M. Boll. Lab. Zool. R. Sc. Agr., Portici, vol. 7, 1912, p. 2, fig. 1.
Silvestri, F. Bd. Agric. and Forestry, Terr. Hawaii, Div. Entom., Bul. 3, 1914, p. 61.

### **Ceratitis punctata** Wiedemann.

(The Cacao Fruit Fly. Trypetidæ; Diptera.)

*Hosts:* Cacao-pods, mango, guava, passion fruit.

*Injury:* Breeds in fruit.

*Biology: Eggs* deposited under peel of ripening pods. Pupates in soil. Life cycle requires from 77 to 92 days for completion.

*Distribution:* Ashanti, West Africa and Uganda, East Africa.

Froggatt, W. W. Proc. Linn. Soc. New South Wales. 1910, vol. 35, pt. 4, p. 863.

### **Ceratitis rubivora** Coquillett.

(Natal Fruit Fly. Trypetidæ; Diptera.)

*Host:* Various cultivated and wild fruits.

*Injury:* Considered one of the most important pests in Natal, infesting both native and cultivated fruits.

*Description: Adult* female 4–5 mm. long, head yellowish, thorax yellowish brown, abdomen yellowish, ovipositor flattened. Biology similar to that of *C. capitata*. (See plate XXVI, fig. *c*.)

*Distribution:* Natal, Cape Town, South Africa.

Froggatt, W. W. Dept. Agric. New South Wales, Farmers' Bul. 24, 1909, p. 48.

### **Ceratitis silvestrii** Bezzi.

(Fruit Fly. Trypetidæ; Diptera.)

*Hosts: Chrysobalanus*, *Butyrospermum parkii*.

*Injury:* Breeds in fruit.

*Description and biology: Adult*, body clay or leather color, face and occiput whitened, thorax with a few black markings. Biology similar to *C. capitata*.

*Distribution:* Senegal, French Sudan.

Bezzi, M. Boll. Lab. Zool. R. Sc. Agr., Portici, vol. 7, 1912.
Silvestri, F. Bd. Agric. and Forestry, Terr. Hawaii, Div. Entom, Bul. 3, p. 63.

### Dacus diversus Coquillett.

(Three-striped Fruit Fly. Trypetidæ; Diptera.)

*Host:* Mango, orange, guava, peach.

*Injury:* Breeds in fruit.

*Description: Adult,* 4–5 mm. long; center of thorax marked with a pale yellow line, with darker regular coloration of the abdomen.

*Distribution:* Ceylon, India.

Froggatt, W. W. Dept. Agric., New South Wales, Farmers' Bul. 24, 1909, p. 16.

### Dacus ferrugineus Fabricius.

(Mango Fruit Fly. Trypetidæ; Diptera.)

*Host:* Fruit of mango (*Mangifera indica*), cucurbitaceous fruits?, ak (*Calotropis* sp.), citrus fruit, *Eugenia malaccensis* ("cabuyao").

*Injury:* Injurious to over-ripe fruit and commonest species in India and Ceylon.

*Description and biology: Adult,* medium size, measuring about 5 mm.; color rusty red, with dorsal surface of thorax varying from black to a rusty red; sometimes the abdomen is marked with almost black bands. Larvæ when in fruit small, yellowish, with pointed head and truncate abdomen; pupate in the soil and emerge as adults in about nine days.

*Distribution:* India, Java, Ceylon, Amboina, Philippine Islands.

Cotes, E. C. Indian Museum Notes, 1896, p. 17.
Maxwell-Lefroy, H. Mem. Dept. Agric. India, Entom. Ser., vol. 1, 1907, p. 227.
Maxwell-Lefroy, H. Indian Insect Pests, 1906, p. 170.
Froggatt, W. W. Dept. Agric., New South Wales, Farmers' Bul. 24, 1909, p. 13.

### Dacus frenchii Froggatt.

(Fruit Fly. Trypetidæ; Diptera.)

*Host:* Fruit of *Artocarpus integrifolia.*

*Injury:* Bred from oranges entering Victoria from New Caledonia.

*Description: Adult,* female about 10 mm. long, with long, rounded body: large hyaline wings with broad costal stripe of light reddish brown; head with large black spot on each side of face and below the base of the antennæ; thorax dull yellowish brown; legs yellow, with tarsi darkest.

*Distribution:* New Caledonia, Java.

Froggatt, W. W. Dept. Agric. New South Wales, Farmers' Bull. 24, 1909, p. 27.
Froggatt, W. W. Proc. Linn. Soc. New South Wales, 1910, vol. 35, pt. 4. p. 866.

### Dacus passifloræ Froggatt.

(The Fiji Fly. Trypetidæ; Diptera.)

*Host:* Granadilla, mango, shaddock; the orange, lemon, and lime are slightly infested.

*Injury:* One of the most abundant fruit flies in Fiji.

*Distribution:* Fiji.

Froggatt, W. W. Proc. Linn. Soc. New South Wales, 1910, vol. 35, pt. 4, p. 870.

### Dacus persicæ Big.

(Peach Fruit Fly. Trypetidæ; Diptera.)

*Hosts:* Mango and peach.

*Injury:* Larvæ injure ripe fruit.

*Description and biology: Adult,* red brown with black and yellow markings on the body. *Eggs* usually deposited in wound on skin of fruit; egg stage about 2 or 3 days;

larval stage 10 to 15 days inside fruit, after which it leaves the fruit and enters the ground to pupate; pupal stage about a week.

*Distribution:* Bhagalpur and Lower Bengal, India.

Basu and Dutt. Crop Pest Handbook for Behar and Orissa, including also Western Bengal, 1913, p. 74.

### Dacus psidii Froggatt.

(South Sea Guava Fruit Fly. Trypetidæ; Diptera.)

*Host:* Guava, granadilla.

*Injury:* Larvæ feed in fruits.

*Description: Adult* female, 6 mm. long, wing expanse 10 mm.; head light brown with rich metallic purple eyes, antennæ brownish black, with last joint black; thorax black; abdomen black, elongate, and narrow at base. (See plate xxvii, figs. 1*a*, 2*a*, 3*a*, 4*a*.)

*Distribution:* Fiji, New Caledonia.

Froggatt, W. W. Dept. Agric., New South Wales, Misc. Pub. 303, 1899.
Froggatt, W. W. Dept. Agric., New South Wales, Farmers' Bul. 24, 1909, p. 19.

### Dacus (Tephrites) xanthodes Broun.

(Broun's Fruit Fly. Trypetidæ; Diptera.)

*Host:* Pineapple, granadilla, guava, mammee apple, shaddock.

*Injury:* Breeds in fruits.

*Description: Adult* female, 9 mm. long, wing expanse 15 mm., general color pale ochreous yellow; thorax with faint yellow dorsal stripe, and pale yellowish white stripe margining each side and marking the sides of the scutellum; abdomen elongate and truncate at apex.

*Distribution:* Fiji. (Bred in New Zealand from fruit imported from Fiji.)

Froggatt, W. W. Dept. Agric., New South Wales, Farmers' Bul. 24, 1909, p. 25.

### Rioxa musæ Froggatt.

(The Island Fruit Fly. Trypetidæ; Diptera.)

*Host:* Banana, *Sideroxylon* (*Achras*) *australe* (black apple).

*Injury:* Larvæ feed in bruised or blemished fruit.

*Description: Adult* female, 6 mm. long, wing expanse 12 mm., head small, ochreous, antennæ yellow with long bristle at apex of second joint, thorax brownish yellow, abdomen small, light brown at base, black on apical half, and covered with coarse hairs. (See plate xxviii, figs. 1, 2.)

*Distribution:* New Hebrides, Queensland, New South Wales.

Froggatt, W. W. Dept. Agric., New South Wales, Misc. Pub. 303, 1899.
Froggatt, W. W. Dept. Agric., New South Wales, Farmers' Bul. 24, 1909, p. 54.

## GOOSEBERRY; CURRANT.

(*Ribes* spp. Family Saxifragaceæ.)

Shrubs bearing small edible fruits; native to Europe, Asia, North America, and South America.

### A. BETTER KNOWN GOOSEBERRY AND CURRANT INSECTS LIKELY TO BE IMPORTED.

### Eriophyes ribis Nalepa.

(Currant Gall Mite. Eriophyidæ; Acarina.)

*Host:* Infests especially the black currant (*Ribes nigrum*), but also *R. rubrum*, and *R. alpinum*. Certain varieties of black currant are preferred, as Baldwin, Black Naples, Black Dutch, and Lee's Prolific.

*Injury:* Seriously injurious; can be introduced in nursery stock.

*Description and biology:* Microscopic. *Adult* about 230 microns long by 40 microns wide. Male smaller; color whitish or pale green, semitransparent and shiny. Subcylindrical in shape; 60–70 transverse rings furnished with regular series of short projections, best seen on sides. Infests the buds which may contain thousands of mites, causing them to swell, producing so-called "big buds." Such buds, if they open, usually fail to produce fruit of value. (See text fig. 62.)

*Distribution:* Middle Europe; England.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 230.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d. ed., 1913, vol. 3, pp. 121–123, figs. 96, 97.

**Bryobia ribis** Thomas.

(Red Gooseberry Mite. Tetranychidæ; Acarina.)

*Hosts:* Gooseberries and currants.

*Injury:* Very serious injury caused by sucking the juices of the plant. Very easy to introduce on nursery stock.

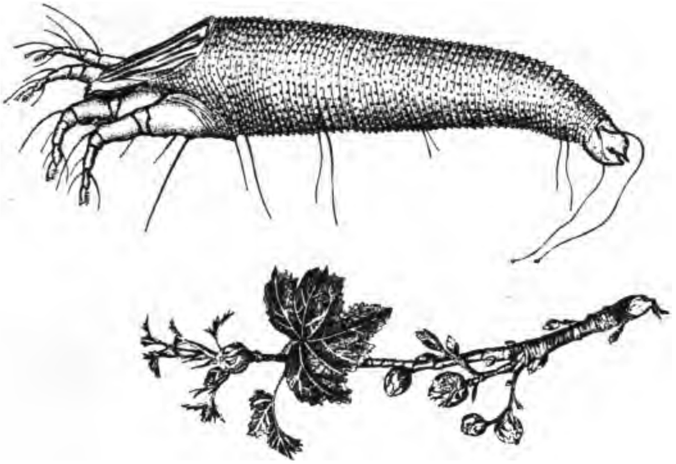


FIG. 62.—Currant gall mite (*Eriophyes ribis*): Mite and galls. (Sorauer.)

*Description and biology:* This is one of the minute red spiders, having eight legs, which breed on the foliage of plants, causing a rusty appearance. The eggs are spherical and microscopic in size.

*Distribution:* Germany, England.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 89–91, figs. 67, 68.

**Abraxas grossulariata** Linnæus.

(Magpie or Currant Moth. Geometridæ; Lepidoptera.)

*Host:* Currant, gooseberry, and fruit trees.

*Injury:* Defoliation; seldom seriously injurious.

*Description and biology:* *Adult* wing expanse 37 mm. (variable); color creamy white, spotted with black, with orange yellow between black spots at base of forewings; hind wings like front, but with no yellow; thorax and abdomen yellow and black. On wing in July and August (England). *Pupa* black, with three golden yellow rings to the body. Cocoon delicate, attached to leaf or twig. *Larva* length 37 mm.;

color creamy white, spotted, and marked with black and orange yellow at sides. Appear in fall; winter as very small larvæ, ready to pupate in June. *Eggs*, cream-colored, laid singly or in groups; hatch in from 6 to 15 days. (See text fig. 63.)

*Distribution*: England, Europe, Siberia, China.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 206.

### **Thamnonoma wauaria** Linnæus.

(Currant Webworm. Geometridæ; Lepidoptera.)

*Hosts: Ribes* spp.

*Injury:* Attacks leaves, buds, flowers, and often fruit.

*Description and biology: Adult,* wing expanse 25 mm.; front wing pure gray with brown and black crosslines; hind wing ashen gray dusted with black. Occurs June and July. *Pupates* in or on ground. *Larva,* length 25 mm.; blue green with darker, white bordered median line, and a yellow side stripe; on each segment a black tubercle bearing bristles. Shortly before pupation mostly violet or reddish brown.

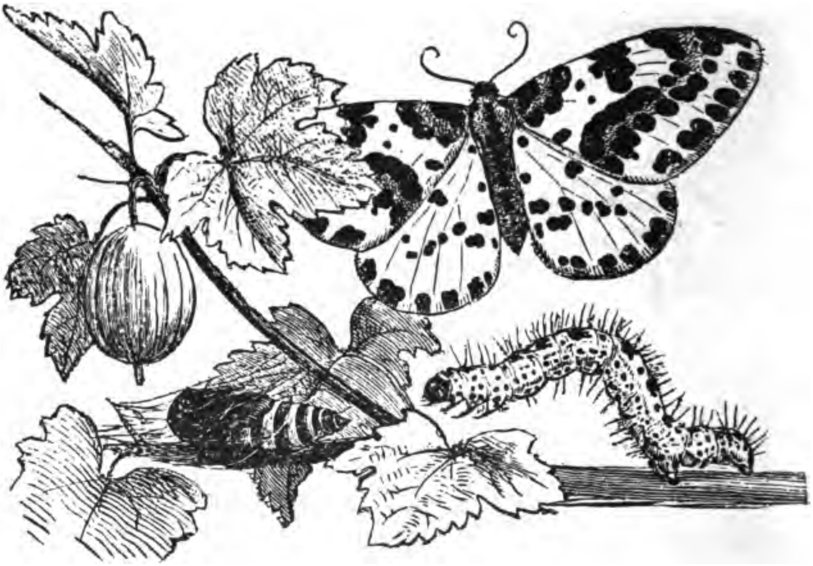


FIG. 63.—Currant moth (*Abraxas grossulariata*): Adult, larva, pupa. (Entom. Parasit. Agric. 1904.)

*Distribution:* Northern Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 336.

### * **Zophodia convolutella** Hübner.

(Pyralidæ; Lepidoptera.)

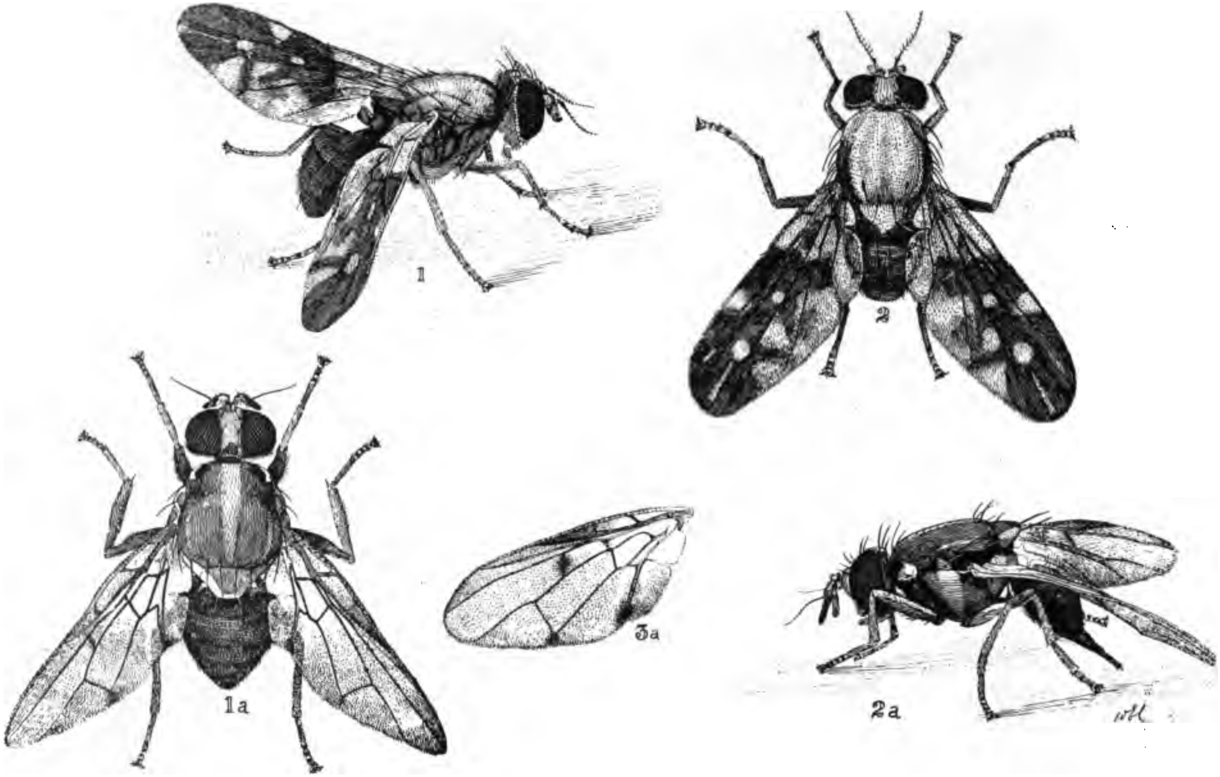
*Hosts:* Gooseberry and currant.

*Injury:* To fruit and leaves.

*Description and biology: Adult,* wing expanse 30 mm.; forewing brownish gray with whitish and dark brown lines; occurs during end of April and beginning of May. (Germany.) *Pupa* overwinters in shallow earth. *Larva,* length 10 mm.; color grass green; head and thoracic shield black; occurs from May until July; draws berries and adjoining leaves together by a web; feeds on fruit. *Egg* deposited singly on twigs (see text fig. 64).

*Distribution:* Europe.

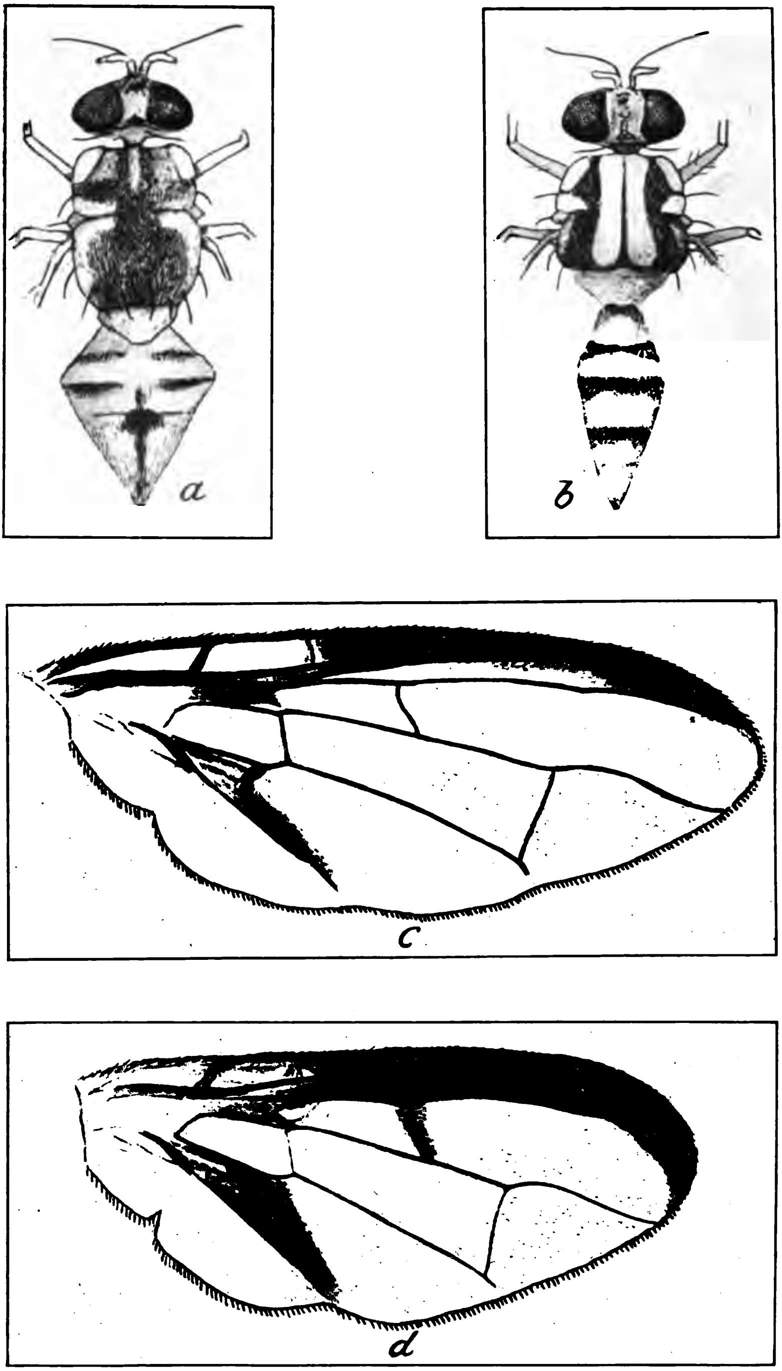
SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d., 1913, vol. 3, p. 336.



FRUIT FLIES LIKELY TO BE IMPORTED.

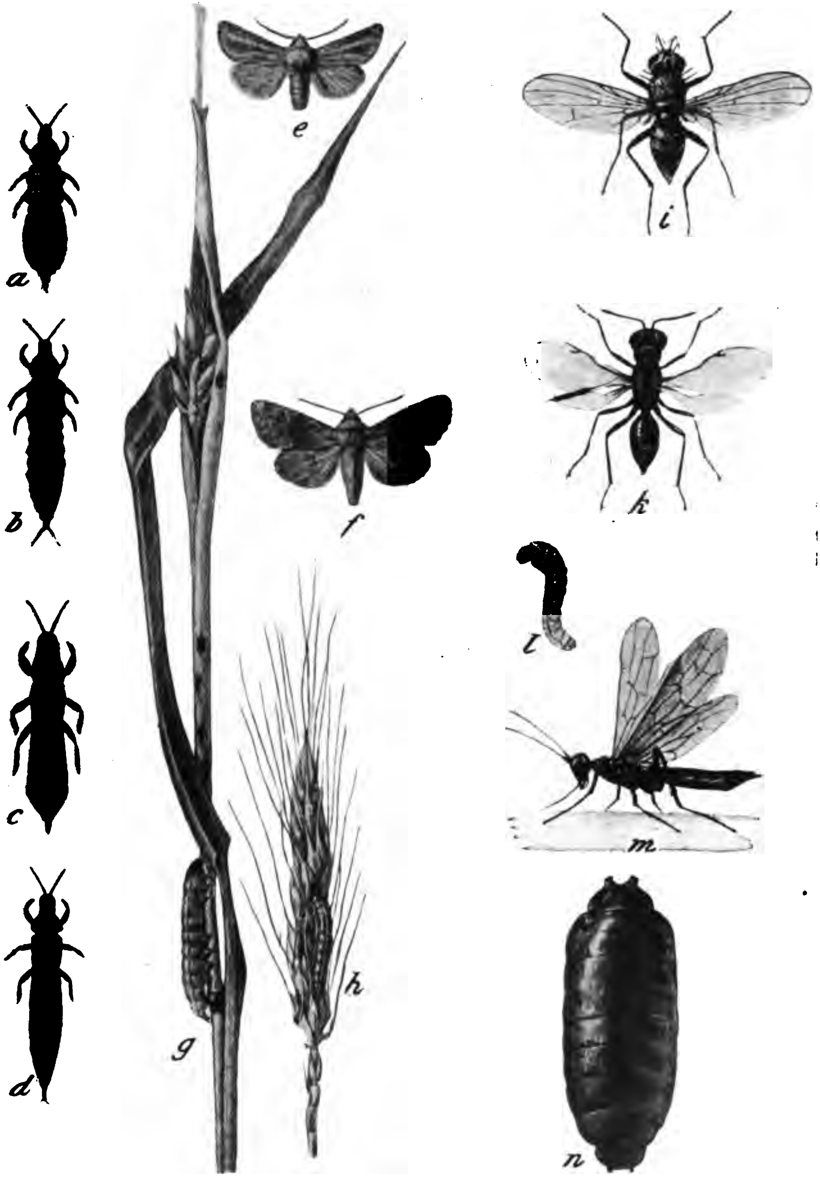
FIGS. 1, 2.—*Rioxa musae.* FIGS. 1*a*, 2*a*, 3*a* .—*Dacus psidii.* (Froggatt.)

PLATE XXVIII.



FRUIT FLIES.

FIGS. *a*, *c*.—The Mandarin fruit fly (*Dacus ornatissimus*) and wing. FIGS. *b*, *d*.—The banana fruit fly (*Dacus curvipennis*) and wing. (Froggatt.)



INJURIOUS GRAIN INSECTS.

FIGS. *a, b.*—*Haplothrips aculeata; c, Limothrips denticornis; d, Haplothrips tritici; e, g, Oria musculosa; f, h, Trachea basilinea; i, n, Hylemyia coarctata; k, Isosoma noxiale: l, m, Trachelus tabidus.* (Kurdjumov.)

### **Incurvaria capitella** Clerck.

(Currant Shoot Borer. Tineidæ; Lepidoptera.)

*Hosts:* Currants; especially red currants.

*Injury:* Seldom serious; tunnels the shoots.

*Description and biology: Adult,* wing expanse ½ inch. Forewings dark brown with purplish iridescence; near base a transverse yellow band and two yellow spots near tip; head deep yellow. Occurs from mid May into June. *Pupa,* brown, in loose cocoons in tunneled shoots. *Larva,* dull greenish, with red patch on ninth segment; head and first thoracic segment black. Hatch in summer, feed on seeds in fruit, then spin hibernaculum on bark; attack buds and shoots in spring causing the tips to wilt; mature in April and May. *Eggs* are colorless, lemon-shaped, 0.67 mm. long.

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 213.

### **Notocelia roborana** Treitschke.

(Currant Fruit Moth. Tortricidæ; Lepidoptera.)

*Host:* Currant, rose, *Rubus* sp., whitethorn, oak.

*Injury:* Hollows out ripening currants.

*Description and biology: Adult,* forewing white, mixed with dull gray before the border; rusty red at point; base gray brown; speculum dotted black; palpi reddish brown. On wing June and July (Germany). *Pupates* in currant leaves and the stage lasts 3 weeks. *Larva,* length 17 mm.; plump, brown, head yellowish brown, neck and anal shield black; on each segment a brown wart, each with a light bristle; webs up leaves and fruit; occurs in early spring.

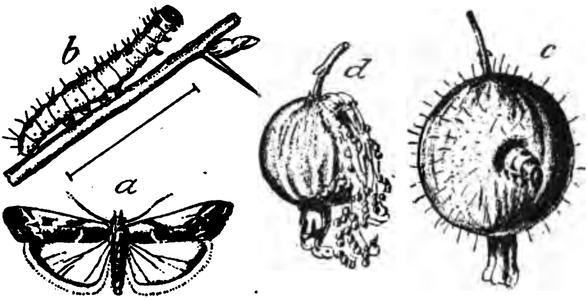


FIG. 64.—Gooseberry moth (*Zophodia convolutella*): Adult larva, injury.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 286.
THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 212.
COLLIGNE, W. A Manual of Injurious Fruit Insects, 1912, p. 163.

## B. OTHER IMPORTANT CURRANT AND GOOSEBERRY INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—
  *Chionaspis salicis* Linnæus; Europe; *Ribes sanguineum.*
  ∗*Epidiaspis piricola* Del Guercio; Italy, France, Portugal, Germany, England.
  *Fiorinia grossulariæ* Maskell; New Zealand.
Unarmored—
  *Lecanium coryli* Linnæus; Great Britain.
  *Lecanium rehi* King; Europe.
  *Lecanium rubi* Schrank; Europe.
  *Phenacoccus socius* Newstead; British Isles.
  *Pseudococcus arecæ* Maskell; New Zealand.

## GRAINS AND GRASSES.

(Family Gramineæ.)

Under this heading are treated the insects attacking the grains and grasses, except corn, sorghum, and sugar cane, which are treated separately. This section relates especially to barley (*Hordeum vulgare* Linnæus), millet (*Panicum* spp.), oats (*Avena sativa* Linnæus), rye (*Secale cereale* Linnæus), timothy (*Phleum pratense* Linnæus), and wheat, emmer, and spelt (*Triticum sativum* Lam.). Descriptions of these various crops are given in their proper alphabetic order.

### A. BETTER KNOWN GRAIN INSECTS LIKELY TO BE IMPORTED.

#### **Lema cyanella** Linnæus; **Lema melanopus** Linnæus.

(Grain Leaf Beetles. Chrysomelidæ; Coleoptera.)

*Hosts:* Grasses, grains, especially oats.

*Injury:* Feed on the leaves, stem and seed. Causes millions of dollars damage in some years.

*Biology: Eggs* shining yellow laid in rows of 10–20 near the midvein, and 40–50 on a leaf. The larvæ feed on the leaves. *L. cyanella* pupates in a cocoon on the plant; *L. melanopus* pupates in the ground. The adults also feed on the foliage.

*Distribution:* Europe, Southwest Asia. Serious only in South Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 509.

#### *****Pharaxonotha kirschi** Reitt.

(Mexican Grain Beetle. Cryptophagidæ; Coleoptera.)

*Hosts:* Corn, yams.

*Injury:* Larvæ and beetles destructive to stored corn and other products.

*Description:* Small, shining, deep brown beetles, about three-sixteenth inch long. Larva elongate gray, each segment darker at middle with darker spaces each side bearing rather well-developed tubercles.

*Distribution:* Brazil, Guatemala, Mexico, Texas, and South Carolina.

Chittenden, F. H. U. S. Dept. Agr., Bur. Entom., Bul. 96, pp. 8–13, fig. 1, 1911.

#### *****Lophocateres (Ostoma) pusillus** Klug.

(Siamese Grain Beetle. Trogositidæ; Coleoptera.)

*Hosts:* Corn, rice, seeds of eggplant and gourd, rye, flour.

*Injury:* Larvæ and beetles destructive to stored corn and other seeds.

*Description:* Flat, brown, with thorax prolonged into acute angles at sides, antennæ clubbed at ends, minute. Larva white with blackish head and last segment elongate.

*Distribution:* Liberia, Siam, Ceylon, Java, India, Cochin China, Peru, Guatemala, France, South Carolina, Texas.

Chittenden, F. H. U. S. Dept. Agr., Bur. Entom., Bul. 96, pp. 14–18, fig. 2. 1911.

#### *****Latheticus oryzæ** Waterh.

(Long-Headed Flour Beetle. Tenebrionidæ; Coleoptera.)

*Hosts:* Wheat, corn, barley, rice.

*Injury:* Larva and beetle injure stored grain and flour.

*Description:* Pale yellow, somewhat flattened beetle; the slenderest of the flour beetles, measuring one-eighth inch.

*Distribution:* India, Arabia, Persia, Norway, England, Russia, Texas.

Chittenden, F. H. U. S. Dept. Agr., Bur. Entom., Bul. 96, pp. 25–28, fig. 5. 1911.

### **Nonagria uniformis** Dudgeon.

(Wheat Stem Borer. Noctuidæ; Lepidoptera.)

*Hosts:* Rice, wheat, sugar cane, millet.

*Injury:* Larva bores in stems and pupates in its borings.

*Description and biology:* Larva flesh colored with black head. Bores in grass stems.

*Distribution:* India, Ceylon, Burma, Celebes.

Maxwell-Lefroy, H. F. Mem. Dept. Agric. India, Ent. Ser., vol. 1, pt. 2, p. 176.

### **Pyrausta nubilalis** Hübner.

(Millet Stalk Worm. Pyralidæ; Lepidoptera.)

*Hosts:* Millet, corn, hops, hemp, *Panicum sanguinale*, *Artemisia vulgaris*, *Conyza squarrosa*, and *Arundo*.

*Injury:* Bores in the stems.

*Description and biology: Moth*, wing expanse 28–30 mm., yellow ochre in color with rust colored marks on forewings. *Larva* dirty gray brown with dark dorsal line, and two black spots on each segment, underside whitish, head dark brown, thoracic shield yellowish, 30 mm. long. Bores in the stems and sometimes attacks the ears of corn. In grasses the larva overwinters in the roots.

*Distribution:* Europe (Hungary).

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 304, 305, fig. 206.

### **Ochsenheimeria taurella** Schiffermiller.

(Rye Stem Borer. Tineidæ; Lepidoptera.)

*Hosts:* Rye, grasses.

*Injury:* Quite injurious to winter rye.

*Description and biology: Moth*, 7 mm. long, with 13 mm. wing expanse, forewings yellowish brown with darker bands, hindwings white in basal part and brown beyond. *Pupates* in the stalk. *Larva* when young greenish or yellow, later yellow with dark head; bores in stems. *Eggs* laid singly.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 242, fig. 175.

### ∗**Tinea granella** Linnæus.

(The Wheat Moth. Tineidæ; Lepidoptera.)

*Hosts:* Wheat, barley.

*Injury:* Very serious injury to the seed heads.

*Description and biology: Adult*, a tiny moth colored a rich brownish yellow with the hindwings larger than the front and greenish yellow. *Pupa* a small brown chrysalid. *Larva* not over one-half inch long, yellowish; bores in the seed head, eating all but the husks.

*Distribution:* Victoria, Australia, Europe, North America.

French, C. Handbook of the Destructive Insects of Victoria, pt. 3, pp. 128–132, pl. 55.

### **Clinodiplosis mosellana** Géhin; **Clinodiplosis equestris** Wagner; ∗**Contarinia tritici** Kirby.

(Grain Gall Midges. Itonididæ [Cecidomyiidæ]; Diptera.)

*Species: Cl. mosellana;* France; wheat, rye. *Cl. equestris;* Europe; wheat. ∗*C. tritici;* Europe, introduced into United States; wheat, rye, barley.

*Injury:* Very serious injury to grain, especially in United States.

*Description:* Fly of *equestris* red, of the other two orange yellow. Maggot of *equestris* blood red, of the other two orange or yellow. Breed in the stems and cause gall formation.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 442, 447, 448.

### Lasioptera cerealis Lindeman.

(Rye Midge. Itonididæ [Cecidomyiidæ]; Diptera.)

*Hosts:* Rye, *Triticum repens*, *Calamagrostis lanceolata*.

*Injury:* Attacks the stems.

*Description and biology: Fly* black, abdomen white banded; 3 mm. long. *Larva* brick red, 5mm. long.

*Distribution:* Russia.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 457.

### Mayetiola avenæ Marchal.

(Oats Gall Midge. Itonididæ [Cecidomyiidæ]; Diptera.)

*Host:* Oats.

*Injury:* Forms galls in the stems.

*Description and biology: Fly* black, marked with red, with a band of silver-gray hairs on each side; length 3.2 mm. Has two generations.

*Distribution:* France.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 449, fig. 272.

### *Phytophaga (Mayetiola) destructor Say.

(Hessian Fly. Itonididæ [Cecidomyiidæ]; Diptera.)

The well-known Hessian fly is a conspicuous example among our imported pests. It is now distributed over Asia, Europe, and North America.

### Porricondyla cerealis Sauter.

(Grain Maggot. Itonididæ [Cecidomyiidæ]; Diptera.)

*Hosts:* Barley, oats, rye, spelt.

*Injury:* Occasionally injurious. Breeds behind the leaf sheath.

*Description and biology: Fly*, antennæ 13-jointed, thorax black, abdomen red, length 2.2 mm. *Maggot*, 3 mm. long, chrome red.

*Distribution:* Germany.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 441.

### Hylemyia coarctata Fallen.

(Wheat Bulb Fly. Anthomyidæ; Diptera.)

*Hosts:* Rye, wheat, barley.

*Injury:* Feeds in the stems; very destructive.

*Description and biology: Fly* yellowish gray, strongly bristled; thorax without stripes; abdomen with dark median stripe; antennæ black; length 7 mm. *Maggot* yellowish, 6 mm. long. (See plate XXIX figs. *i*, *n*.)

*Distribution:* Middle and north Europe. One specimen is recorded from Colorado.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 431, 432, fig. 263.

**Hydrellia griseola Fallen.**

(Grain Leaf Miner. Ephydridæ; Diptera.)

*Hosts:* Barley, oats, grasses.
*Injury:* Mines the leaves.
*Description and biology: Adult* fly metallic brown, thickly dusted with gray; undersides and palpi yellow; antennæ black, face and beak brown; 2.75 mm. long. *Larva* 2 mm. long.
*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 408, 409, fig. 254.

**Camarota flavitarsis Meigen.**

(Grain Fly. Oscinidæ; Diptera.)

*Hosts:* Wheat, grasses.
*Injury:* Bores in stems.
*Description and biology: Fly,* blue black, undersides white, length 2.5 mm. *Larva* and pupa with two large stigmal hooks at apex.
*Distribution:* France.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 412, 413.

**Chlorops tæniopus Meigen.**

(Straw Fly. Oscinidæ; Diptera.)

*Hosts:* Wheat, rye, barley, grasses.
*Injury:* Bores in the stems of grains.
*Description and biology: Fly,* yellow, with three black lines on thorax, four black cross bands on abdomen and black antennæ; length, 3–4 mm. *Maggot,* yellowish white, 5–7 mm. long. Winters in stem near roots.
*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 412, 413.

***Oscinis frit** Linnæus (**Oscinis pusilla Meigen**).

(Frit Flies. Oscinidæ; Diptera.)

*Hosts:* Oats, barley, wheat, rye.
*Injury:* Mines the stems of grains. Serious pests.
*Description and Biology: Adult* fly, shining black, metallic. *Larva,* white, legless. Mines the stems and roots.
*Distribution:* Europe, America.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 410, 411.

## B. OTHER IMPORTANT GRAIN INSECTS.

### HEMIPTERA.

**Lygæidæ.**

*Nysius vinitor* Bergroth; Australia. (See Fruit.)

**Jassidæ.**

*Jassus sexnotatus* Fallen of Germany is a very injurious insect to wheat, barley, oats, and grasses. The eggs might be imported with straw during the winter. This is a bright-yellow leaf hopper with black markings, measuring about 3.75 mm. in length.

### THYSANOPTERA.

*Haplothrips tritici* Kurdjumov, the Europe grain thrips; Europe; often winters in wheat stubbles. (See pl. XXIX, fig. *d.*)

*Haplothrips aculeata* Fabricius (see pl. XXIX, figs. *a, b) and Limothrips denticornis* Haliday; Europe; attack grain. (See pl. XXIX, fig. *c.*)

### COLEOPTERA.

**Carabidæ.**

*Zabrus gibbus* Fabricius of Europe attacks wheat, oats, rye, and barley, in both its adult and larval stages. It is a shining black beetle with piceous antennæ and legs, measuring 15 mm. in length and 6 mm. in breadth. The adults hide during the day and feed at night on the grain. They might easily be imported.

**Elateridæ.**

*Agriotes lineatus* Linnæus. (See Tobacco.)

**Cerambycidæ.**

*Calamobius marginellus* Fabricius; Europe; bores in stems of wheat.

**Chrysomelidæ.**

*Phyllotreta vittula* Redtenbacher. (See Rape.)

**Brachyrhinidæ.**

*Diaprepes abbreviatus* Linnæus; West Indies. (See Sugar cane.)

### LEPIDOPTERA.

**Noctuidæ.**

*Oria musculosa* Hübner; Russia; very destructive, winters in egg stage in stubble. (See pl. XXIX, figs. *e*, *g*.)

*Hadena secalis* Bjerk; Europe; bores in stalks.

*Trachea basilinea* W. V.; Europe; injures wheat, rye, and other grains. (See pl. XXIX, figs. *f*, *h*.)

**Pyralidæ.**

*Chilo simplex* Butler; India, Formosa; attacks millet. (See Sugar Cane.)

*Dichocrocis punctiferalis* Guénée; Queensland; attacks millet. (See Corn.)

**Phycitidæ.**

*Anerastia botella* Zuk.; Europe; injurious to rye, wheat, and other cereals.

### DIPTERA.

**Oscinidæ.**

*Chlorops lineata* Fabricius; a tiny reddish frit fly of Europe which breeds in stems of wheat.

*Opomysa florum* Fabricius, a small fly of Europe which breeds during the winter in the lower parts of the stems of wheat. It is 4.5 mm. long, pale yellow or reddish yellow in color.

**Itonididæ (Cecidomyidæ).**

*Clinodiplosis mosellana* Géhin; Europe; breeds in stems of wheat and rye.

### HYMENOPTERA.

**Cephididæ.**

* *Cephus pygmaeus* Linnæus of Europe bores in the stems of wheat, rye, timothy, and other cereals and grasses hibernating as a larva in the lower part of the stem or root. It could easily be imported in straw. The larva is legless. The adult is a black wasplike insect with yellow markings, measuring 7 mm. in length.

*Trachelus tabidus* Linnæus; Europe; bores in stems. (See pl. XXIX, figs. *l*, *m*.)

**Chalcididae.**

*Isosoma noxiale* Portschinski is a very injurious chalcid pest of grain in Russia. The larvæ pass the winter in the stems. (See pl. XXIX, fig. *k*.)

## GRANADILLA.

(*Passiflora quadrangularis.* Passifloraceæ.)

A tropical American vine valuable as a climber and also for its fruit.

### DIPTERA.

**Trypetidæ.**

*Dacus passifloræ* Froggatt; Fiji. (See Fruit.)

*Dacus psidii* Froggatt; Fiji. (See Fruit.)

*Dacus xanthodes* Broun; Fiji. (See Fruit.)

*Ceratitis capitata* Wiedemann. (See Fruit.)

*Ceratitis punctata* Wiedemann; Africa. (See Fruit.)

### LEPIDOPTERA.

**Pyralidæ.**

*Dichocrocis punctiferalis* Guénée; Queensland. (See Corn.)

## GRAPE.

(*Vitis* spp. Family Vitaceæ.)

Fruit-bearing vines valued both for the fruit itself and for the wines derived therefrom.

### A. BETTER KNOWN GRAPE INSECTS LIKELY TO BE IMPORTED.

#### * Eriophyes vitis Landois.

(Grape Blister Mite. Eriophyidæ; Acarina.)

*Hosts:* *Vitis vinifera*, *V. vesuviana*, *V. carinthiaca*, *V. arizonica*, *V. æstivalis*.

*Injury:* Causes much damage to the vine.

*Description and biology:* Four-legged blister mite which attacks the leaves, buds, flowers, and berries of the grape.

*Distribution:* Europe, Armenia, North America.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 119, 120, figs. 94, 95.

#### Anomala vitis Fabricius.

(Grape Anomala. Scarabæidæ; Coleoptera.)

*Host:* Grape.

*Injury:* May be serious.

*Description and biology:* *Adult*, length 12–17 mm.; green, violet or azure; body oval; head, prothorax, and scutellum punctate; elytra convex with distinct longitudinal striæ. Occurs in June and July; crepuscular; feeds on foliage of the vine. *Pupates* in soil in May; stage requires about a month. *Larva* feeds on roots of grass and the vine. Feeds about a year and a half. *Egg* oblong, hatches in about 15 to 20 days.

*Distribution:* Middle and eastern Europe.

Silvestri, F. Dispense di Entomologia Agraria, 1911, p. 310.

#### Sinoxylon perforans Schrk.; Sinoxylon sexdentatum Olivier.

(Grape-vine Flat-headed Borers. Bostrychidæ; Coleoptera.)

*Species:* *S. perforans;* Tirol, Italy, grape; Europe, oak, elm, horse chestnut. *S. sexdentatum;* Spain, grape; South France, *Quercus sessiliflora*.

*Injury:* Bore in the stems, branches, and trunk; sometimes causing very serious injury.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 489.

#### Vesperus spp.

(Grape Borers. Cerambycidæ; Coleoptera.)

*Species:* *V. xatarti* Dufour; France; grape. *V. luridus* Rossi; Italy; grape. *V. strepens* Fabricius; France; grape, rose, forest trees. *V. mauretanicus* Dry; Algeria, Spain; grape, olive.

*Injury:* Bore in stems.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 498.

#### * Bromius obscurus Linnæus.

(Grape Root Worm. Chrysomelidæ; Coleoptera.)

*Hosts:* Grape, *Epilobium*, etc.

*Injury:* Sometimes serious. Attacks both the roots and the growing parts of the vine.

*Description and biology:* The species has two varieties, *obscurus*, which is black, and *vitis* Fabricius, which is brown. The eggs are laid in crevices beneath the inner layers of bark on old wood, and also on leaves, in clusters of 4 to 30. *Eggs* yellowish white, elongate cylindrical. *Larva* white, with yellowish-brown head, short legs. *Pupa* white, formed in earthen cell. The larva feeds on the roots several feet under ground, doing much damage. The adults feed on the foliage and fruit.

*Distribution:* Europe, Asia, North Africa, and introduced into California.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 512, 513.
QUAYLE, H. J. California Agr. Exp., Sta. Bul. 195, 25 pp., 18 figs.

### Haltica ampelophaga Leesb.

(Vine Flea-beetle. Chrysomelidæ; Coleoptera.)

*Hosts:* Grape, willow.

*Injury:* Serious. Defoliation.

*Description and biology: Adult,* length 4 mm.; brilliant green, sometimes deep blue-green. Two generations, first appears in April (France), feeds on leaves. Pass winter as adults at bases of vines, in bark, etc. *Pupate* in soil. *Larva,* length 6 mm., black; feeds on leaves, flowers, and shoots. Larval period of first generation about a month. *Eggs* clear yellow, oblong; placed on under surface of leaves in clusters of about 30. (See text fig. 65.)

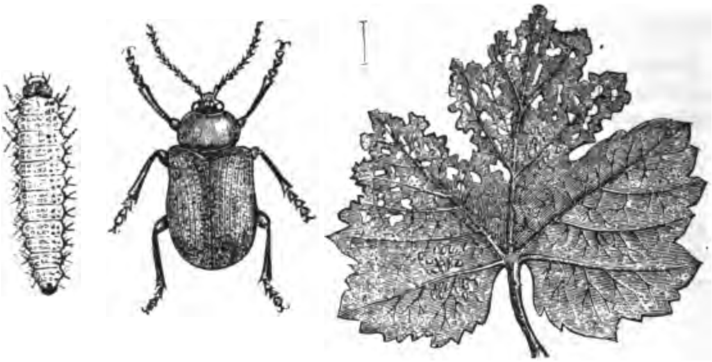


FIG. 65.—Vine flea-beetle (*Haltica ampelophaga*): Adult, larva, and injury. (v. Rendu.)

*Distribution:* France, Italy, Spain, Algiers.

MONTILLOT, L. Les Insectes Nuisibles, 1891, p. 116.
GUENAUX, G. Entomologie et Parasitologie Agricoles, 1904, p. 340.
SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 523, 524.

### Scelodnota strigicollis Motschulsky.

(Chrysomelidæ; Coleoptera.)

*Host:* Grape.

*Injury:* Serious pest.

*Description and biology:* Probably similar to grape rootworm.

*Distribution:* India.

MAXWELL-LEFROY, H. F. Indian Insect Life, 1909, p. 359.

### Brachyrhinus (Otiorhynchus) spp.

(Grape Root Weevils. Brachyrhinidæ (Otiorhynchidæ); Coleoptera.)

The weevils of this genus breed at the roots of plants and are very destructive as adults, often defoliating vineyards.

*Species*: *B. raucus* Fabricius; Germany, France; adults attack foliage of apple, pear cherry, grape. *B. singularis* Linnæus; Europe (England); adults attack grape, grafted fruit trees, oak, rose, hops, *Rhododendron*, pines, gherkins, spruce, and strawberries. *B. turca* Boheman; Russia; breeds at the roots of grape. ✳*B. sulcatus* Fabricius; Europe, introduced into America and Australia; breeds at the roots of grape, strawberry, and many other plants and is a very destructive pest. *B. populeti* Boheman; Hungary; adults injurious to grape. *B. ligustici* Linnæus; Europe; attacks grape, peach, hops, beans, beets, asparagus, lucerne. Breeds at the roots and is very destructive. *B. armatus* Boheman, *B. asphaltinus* Germar, *B. corruptor* Host., *B. globus* Boheman, *B. teretirostris* Stierlin and *B. tristis* Scopoli are also recorded from grape.

*Description*: These weevils are practically all black, oval, fairly large, with broad blunt beaks.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 541–543.

BARGAGLI, P. Rassegna Biologia Rincofori Europei, 1883–1887.

### **Boarmia gemmaria** Brahm.

(Geometridæ; Lepidoptera.)

*Hosts:* Grape, wild honeysuckle, rose.

*Injury:* Very injurious. Defoliation.

*Description and biology*: *Adult*, wings 19–20 mm.; brownish gray with white markings. *Larva*, grayish brown in color, with dark yellow and black spots and dark wavy side lines; occurs in July; winters in sheltered places. *Pupates* during spring in ground.

*Distribution*: Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 338.

### **Cryptoblabes gnidiella** Mill.

(Pyralidæ; Lepidoptera.)

*Host*: Grape.

*Injury*: To fruit.

*Description*: *Adult*, wings lead gray, two diagonal whitish stripes between which are blackish spots. *Larva*, length 14 mm., dirty brown with broad, dark side stripes. Feeds on unripe grape berries.

*Distribution:* Southern Europe, Egypt.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 311.

### **Sciopteron regale** But.

(Grape Gun Worm. Sesiidæ; Lepidoptera.)

*Host:* Grape.

*Injury;* Bore in canes of the grape; very destructive in Japan.

*Description and biology: Adult* moth, about 18 mm. long and with wing expanse of 37 mm.; general color orange and black. *Larva,* 18 to 25 mm. long, yellow, feet and head darkish brown. *Pupa,* about 18 mm. long, rich amber brown in color.

*Distribution:* Japan.

MASKEW, F. Cal. State Hort. Com. Monthly Bulletin, vol. 2, No. 10, 1913, p. 677.

### **Clysia ambiguella** Hübner.

(The Cochylis. Tortricidæ; Lepidoptera.)

*Host:* Grape.

*Injury:* Very serious to blossom clusters and fruit. One of the worst grape pests of Europe.

*Description and biology: Adult*, wing expanse 14–15 mm.; forewing yellow, with a large dark brown transverse band; hindwing gray. Two generations. First occurs at time of flowering of grape; second generation in early August (France). *Pupates* in early winter under bark scales, in crevices of grape stakes, etc. *Larva*, length 12 mm., at first whitish, later taking on a rose color. *Egg* placed singly on blossom clusters and on grapes. (See text fig. 66.)

*Distribution*: Europe, Asia Minor, Japan, India.

Montillot, L. Entomologie et Parisitologie Agricoles, 1904, p. 335.

### Polychrosis botrana Schiffermiller.

(The Pyralid of the Vine. Tortricidæ; Lepidoptera.)

*Host:* Grape.

*Injury*: Very injurious. Attacks grape blossoms and fruit.

*Description and biology*: *Adult*, wing expanse 12 mm.; forewings pale yellow with three transverse brown lines; hind wings grayish brown. Three annual generations. *Pupa* brown. *Larva*, length 1 cm.; green in color. *Eggs* deposited on berries and on blossom clusters. (See text fig. 67.)

*Distribution*: Germany, Austria-Hungary, Switzerland, France, Italy, Asia Minor.

Montillot, L. Les Insectes Nuisibles, 1891, p. 120.

Guénaux, G. Entomologie et Parasitologie Agricoles, 1904, p. 340.

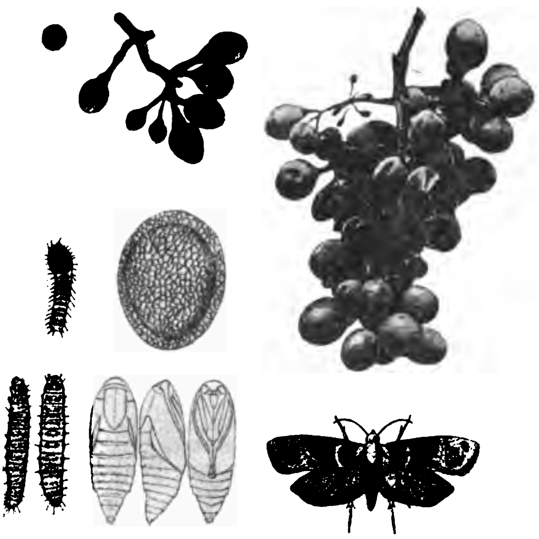


Fig. 66.—Grape worm (*Clysia ambiguella*): Adult, pupæ, larvæ, egg, and injured grapes. (Silvestri, Sorauer.)

## IMPORTANT GRAPE INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—

- *Aspidiotus* (*Evaspidiotus*) *labiatarum* Marchal; Corsica, Italy.
- *Aspidiotus* (*Pseudaonidia*) *articulatus* Morgan; West Indies.
- *Aspidiotus* (*Pseudaonidia*) *tesserata* De Charmoy; Mauritius, Mexico, Antigua.
- *Aspidiotus* (*Chrysomphalus*) *pedroniformis* Cockerell and Robinson; Philippines; *Vitis vinifera*.
- *Aspidiotus* (*Pseudaonidia*) *fossor* Newstead; Barbados.
- *Aspidiotus* (*Targionia*) *vitis* Signoret; France, Algiers, Germany, Italy, Sicily.
- *Chionaspis vitis* Green; Ceylon, Japan.

Unarmored—

- *Cryptinglisia lounsburyi* Cockerell; on roots; Cape Colony.
- *Gueriniella serratulæ* Fabricius; Algeria; Europe.
- *Icerya palmeri* Riley & Howard; Mexico.
- ***Lecanium persicæ* Fabricius; Australia, France, Italy, Caucasus, California.
- *Lecanium vini* Bouché; France.
- *Neolecanium silveirai* Hempel; on roots; Brazil.
- ***Palæococcus rosæ* Riley & Howard; Jamaica.
- *Pseudococcus filamentosus* Cockerell; Japan, Hawaii.
- *Pseudococcus subterraneus* Hempel; on roots; Argentina.
- *Pseudococcus vitis* Niedielski; North Africa, France, Europe, Palestine.
- *Pulvinaria vinifera* King.
- *Rhizœcus falcifer* Künckel; France, Algeria.
- *Solenococcus muratæ* Kuwana; Japan.

**Lygæidæ.**

- *Nysius vinitor* Bergroth; Australia. (See Fruit.)

### COLEOPTERA.

**Buprestidæ.**

✱*Agrilus viridis* Linnæus; Europe. (See Oak.)

**Scarabæidæ.**

*Adoretus umbrosus* Fabricius; Pacific Islands. (See Rose.)

**Cerambycidæ.**

*Cerambyx miles* Bon.; Austria; bores stems of *Vitis vinifera*.
*Heterachthes æneolus* Bates; Mexico; bores stems of *Vitis vinifera*.

**Curculionidæ.**

*Orthorrhinus kluggi* Schönherr; Victoria; bores in canes.

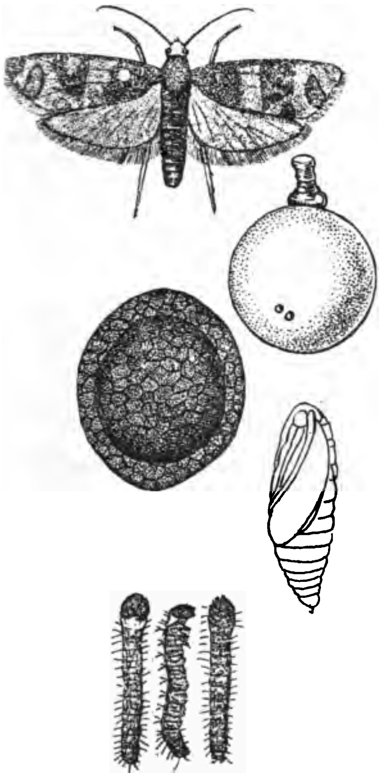


FIG. 67.—Grape pyralid (*Polychrosis botrana*): Adult, larvæ, pupa, egg, and injured grape. (Silvestri.)

### LEPIDOPTERA.

**Tortricidæ.**

*Capua angustiorana* Haworth; Europe, Asia, Africa. (See Apricot.)

**Zygænidæ.**

*Ina ampelophaga* Boyle; Europe, Caucasus, Palestine; attacks buds and leaves.

### DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann, attacks *Vitis vinifera*. (See Fruit.)

**Itonididæ.**

*Contarinia viticola* Rübsaamen; Europe; breeds in buds and flowers.

## GUAVA.

(*Psidium guajava*, etc. Family Myrtaceæ.)

Evergreen trees and shrubs of tropical and subtropical America, yielding delicious fruits. Several species are grown in Florida and California.

### IMPORTANT GUAVA INSECTS.

### HEMIPTERA.

**Coccidæ.**

Armored—
✱*Aspidiotus* (*Pseudaonidia*) *articulatus* Green; Jamaica.
*Aspidiotus* (*Pseudaonidia*) *trilobitiformis* Green; Ceylon. (See citrous.)
✱*Parlatoria ziziphus* Lucas; Philippine Islands.
*Chionaspis* (*Phenacaspis*) *megaloba* Green; Ceylon.

Unarmored—
*Cardiococcus umbonatus* Cockerell; Mexico.
*Ceroplastes campinensis* Hempel; Brazil.
*Ceroplastes grandis* Hempel; Brazil.
*Ceroplastes psidii* Chavannes; Brazil, Europe.
*Ceroplastes singularis* Newstead; British East Africa, Uganda.
*Ceroplastes vinsonii* Signoret; Mauritius.
*Coccus acuminatus* Signoret; Hawaii, Ceylon.
*Coccus viridis* Green; Uganda, India, Mauritius, Ceylon, Brazil.
*Eriococcus coriaceus* Maskell; Victoria, New South Wales, Queensland.
*Icerya montserratensis* Riley & Howard; New South Wales; *Psidium pomiferum*.
*Icerya seychellarum* Westwood; Mauritius.
*Inglisia conchiformis* Newstead; Uganda.
*Pseudococcus grandis* Hempel; Brazil.
*Pseudococcus virgatus* Cockerell; China, Japan, Jamaica.
*Pseudokermes nitens* Hempel; Brazil.
*Pulvinaria cupaniæ* Cockerell; Jamaica.
*Pulvinaria ficus* Hempel; Brazil, Barbados, Montserrat, Antigua, St. Kitts.
*Saissetia discoides* Hempel; Brazil.
*Saissetia psidii* Green; Ceylon.

**Aleyrodidæ.**

*Aleurodicus cocois* Curtis; West Indies, Mexico, Central and South America, attacks *Psidium guajava*. (See Coconut.)

### THYSANOPTERA.

**Heliothrips rubrocinctus* Giard; West Indies, Ceylon, Uganda, Florida, attacks *Psidium guajava*. (See Fruits.)

### COLEOPTERA.

**Brachyrhinidæ.**

*Diaprepes abbreviatus* Linnæus; West Indies. (See Sugar cane.)

### LEPIDOPTERA.

**Lycænidæ.**

*Virachola isocrates* Fabricius; India; bores in fruit. (See Fruit.)

**Pyralidæ.**

*Dichocrocis punctiferalis* Guénée; Queensland. (See Corn.)

**Lasiocampidæ.**

*Suana concolor* Walker; Java.

### DIPTERA.

**Trypetidæ.**

*Anastrepha fraterculus* Wiedemann, attacks *Psidium guajava*. (See Fruit.)
*Anastrepha serpentina* Wiedemann, fruit fly; Lesser Antilles; attacks *Psidium guajava*.
*Anastrepha ludens* Loew; Mexico. (See Fruit.)
*Ceratitis capitata* Wiedemann; attacks *Psidium cattleianum* and *P. guajava*. (See Fruit.)
*Ceratitis punctata* Wiedemann; Africa. (See Fruit.)
*Ceratitis anonae* Graham; Africa. (See Fruit.)
*Dacus psidii* Froggatt; Fiji. (See Fruit.)
*Dacus xanthodes* Broun; Fiji. (See Fruit.)
*Dacus diversus* Coquillett; India. (See Fruit.)

## HAWTHORN; MEDLAR.

(*Mespilus* spp. [*Crataegus*]. Family Rosaceæ.)

Small fruit-bearing trees and shrubs of the northern hemisphere, grown mainly as ornamental shrubbery.

### IMPORTANT HAWTHORN INSECTS.

### ACARINA.

**Eriophyidæ.**

*Eriophyes goniothorax* Nalepa, blister mite; England; attacks leaves of *Mespilus oxyacantha*.

### HEMIPTERA.

**Coccidæ:**

Armored—
*Aspidiotus* (*Diaspidiotus*) *pyri* Lichtenstein; Europe; *Mespilus heterophylla*, *M. oxyacantha*.
*Diaspis leperii* Signoret; Europe; *Mespilus monogyna*.

Unarmored—
*Ceroplastes rusci* Linnæus; Europe.
**Lecanium bituberculatum* Targioni-Tozzetti; Europe; Oregon; *Mespilus monogyna*, *M. oxyacantha*.
*Lecanium coryli* Linnæus; Europe; *Mespilus coccinea*, *M. germanica*, *M. monogyna*, *M. oxyacantha*, *M. pyracantha*.
*Pulvinaria betulae;* Europe; *Mespilus germanica*, *M. monogyna*, *M. oxyacantha*.

### COLEOPTERA.

**Curculionidæ.**

*Magdalis cerasi* Linnæus and *M. pruni* Linnæus; Europe; breed under bark.
*Magdalis barbicornis* Latreille; Europe. (See Apple.)

### LEPIDOPTERA.

**Geometridæ.**

*Hibernia aurantiaria* Esp., *H. defoliaria* Linnæus and *H. marginaria* Borckh; Germany; defoliators.

**Lymantriidæ.**

*Dasychira pudibunda* Linnæus and **Euproctis chrysorrhœa* Linnæus; Europe; defoliators. (See Forest defoliators.)

**Lasiocampidæ.**

*Gastropacha quercifolia* Linnæus; Europe. (See Fruit.)

**Hyponomeutidæ.**

*Argyresthia nitidella* Fabricius; England. (See Plum.)

DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann. (See Fruit.)

HYMENOPTERA.

**Tenthredinidæ.**

*Macrophya punctum-album* Linnæus; Russia; sawfly.

*Priophorus padi* Linnæus; Europe (See Plum.)

LITERATURE.

SORAUER. P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
LINDINGER, L. Die Schildläuse (Coccidæ), 1912

## HAZEL; FILBERT; COBNUT.

(*Corylus* spp. Family Corylaceæ.)

Valuable nut-bearing shrubs or rarely trees of America, Europe, and Asia, sometimes used for shrubbery.

### A. HAZEL INSECTS LIKELY TO BE IMPORTED.

**Eriophyes avellanæ** Nalepa; **Eriophyes vermiformis** Nalepa.

(Hazelnut Blister Mites. Family Eriophyidæ; Acarina.)

*Hosts: Corylus avellana, C. tubulosa.*

*Injury:* Cause galls on buds. Serious in England.

*Description and biology:* Four-legged blister mites which form galls in the spring and summer buds. Very easy to introduce on nursery stock.

*Distribution:* England, Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 1913, 3d ed., vol. 3, p. 118, fig. 93.

**Oberea linearis** Linnæus.

(Cerambycidæ; Coleoptera.)

*Hosts:* Hazelnut, walnut.

*Description and biology: Adult,* beetle occurs from May on. A generation in two years. The *larva* eats pith and wood and pupates in earth. *Eggs* are placed singly under young bark. After oviposition the female rings the twig.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 1913, 3d ed., vol. 3, p. 507.

**Curculio nucum** Linnæus (**Balaninus**).

(Nut Weevil. Curculionidæ; Coleoptera.)

*Hosts:* Hazelnut, filbert, cob, oak.

*Injury:* Causes nuts to fall prematurely.

*Description and biology: Adult,* length 8 mm.; color tawny brown to chocolate brown, densely clothed with golden-brown pubescence; has unusually long snout; occurs in June and July (England). Flies in bright weather. *Pupa* creamy white, pupates in soil. *Larva* length rather more than 8 mm.; creamy white; passes winter in cell in ground. *Eggs* are deposited singly, deep in nut. Incubation requires 8 or 10 days. (See text fig. 68.)

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 299.

### Laspeyresia amplana Hübner (Carpocapsa.)

(Nut Tortrix. Tortricidæ; Lepidoptera.)

*Hosts:* Hazelnut, walnut.

*Injury:* To fruit.

*Description and biology:* Forewing cinnamon colored, with large light spots on both sides darkened by brown spots on the inner margin. Flies in July (Germany). *Larva*, dirty white; head and back darker; bores into the nuts; overwinters in soil, pupating in spring. *Eggs* deposited on unripe nuts.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 276.

Henschel, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 432.

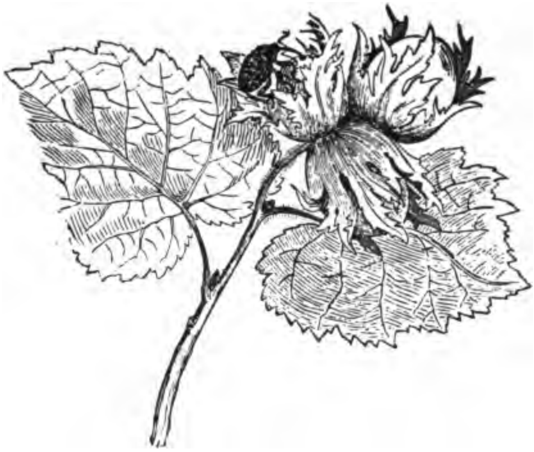


Fig. 68.—The nut weevil (*Curculio nucum*): Adult puncturing nut. (Guenaux.)

## B. IMPORTANT HAZEL INSECTS.

HEMIPTERA.

**Coccidæ.**

Unarmored—

*Lecanium coryli* Linnæus; Europe; *Corylus avellana, C. colurna.*

*Lecanium pulchrum* Marchal; Europe; *Corylus avellana.*

*Phenacoccus aceris* Signoret; Europe; *Corylus avellana.*

*Pulvinaria betulæ* Linnæus; Europe; *Corylus avellana.*

COLEOPTERA.

**Buprestidæ.**

*Agrilus angustulus* Illiger; *A. subauratus* Gebler; Europe; bore in bast and sapwood, especially of saplings.

**Elateridæ.**

*Athous subfuscus* Müller, wireworm; Europe; injures nuts and seedlings.

**Cerambycidæ.**

*Oberea linearis* Linnæus; Europe; bores in pith of nursery stock.

**Chrysomelidæ.**

*Haltica quercetorum* Foudr.; Europe; leaf beetle. (See Oak.)

**Curculionidæ.**

*Magdalis carbonaria* Linnæus; Europe; bores in trunks. (See Birch.)

LEPIDOPTERA.

**Geometridæ.**

*Anisopteryx æscularia* Schiffermiller; Europe; feeds on foliage.

**Lymantriidæ.**

*Dasychira pudibunda* Linnæus, and **Lymantria monacha* Linnæus; Europe; defoliators. (See Forest defoliators.)

**Notodontidæ.**

*Phalera bucephala* Linnæus; Europe. (See Forests.)

**Tortricidæ.**

*Laspeyresia grossana* Haworth (*Carpocapsa*); Europe. (See Beech.)

**Hyponomeutidæ.**

*Argyresthia ephippella* Fabricius; Europe. (See Plum.)

HYMENOPTERA.

**Tenthredinidæ.**

*Monoctenus juniperi* Linnæus; Europe; sawfly feeds on foliage.

### LITERATURE.

**Sorauer, P.** Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
**Nüsslin, Otto.** Leitfaden der Forstinsektenkunde, 2d ed., 1913.
**Hess, R.** Der Forstschutz, 1900, vol. 2.
**Lindinger, L.** Die Schildläuse (Coccidæ), 1912.

## HEMLOCK SPRUCE.

(*Tsuga* spp. Family Pinaceæ.)

Ornamental evergreen trees, very useful for parking, native of North America, East Asia, and the Himalayas. For convenience the insect pests are arranged under Conifers.

## HEMP.

(*Cannabis sativa* Linnæus. Family Urticaceæ.)

A native of Asia cultivated for the fiber obtained from its stems. Also used as an ornamental plant.

### IMPORTANT HEMP INSECTS.

#### COLEOPTERA.

**Chrysomelidæ.**
*Psylliodes attenuata* Koch; Europe. (See Hops.)

#### LEPIDOPTERA.

**Pyralidæ.**
*Pyrausta nubilalis* Hübner; Europe. (See Grain.)

## HOPS.

(*Humulus lupulus* Linnæus. Family Urticaceæ.)

Vines cultivated in Europe and America for the hops, which are used in the brewing of beer.

### A. BETTER KNOWN HOPS INSECTS LIKELY TO BE IMPORTED.

#### Psylliodes attenuata Koch.

(European Hop Flea-Beetle. Family Chrysomelidæ; Coleoptera.)

*Hosts:* Hops, hemp, stinging nettle.

*Injury:* Feeds on foliage. The larva is supposed to breed in the cones of the hops.

*Distribution:* Europe (Russia, England).

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 522.

#### Hepialus humuli Linnæus.

(Hop Root Borer. Hepialidæ; Lepidoptera.)

*Hosts:* Hops, potato, rape, corn, sorrel, dandelion.

*Injury:* Bores in the roots.

*Description and biology: Moth,* wing expanse 43–68 mm.; male above silvery white, beneath brownish gray, female clay yellow, with pale brick-red marks on forewings. *Larva* yellowish, spotted with black, with dark head; thoracic shield and spots on second and third segments yellowish brown; 50–55 mm. The larva breeds in the roots.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 320.

#### Cecidomyia humuli Theobald.

(Hop Midge. Itonididæ [Cecidomyidæ]; Diptera.)

*Host:* Hops.

*Injury:* Attack the catkins.

*Description and biology:* Fly very small; larvæ white.
*Distribution:* England.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 443.

### Agromyza frontalis Meigen.

(Hop Leaf Miner. Agromyzidæ; Diptera.)

*Host:* Hops.
*Injury:* Mines the leaves.

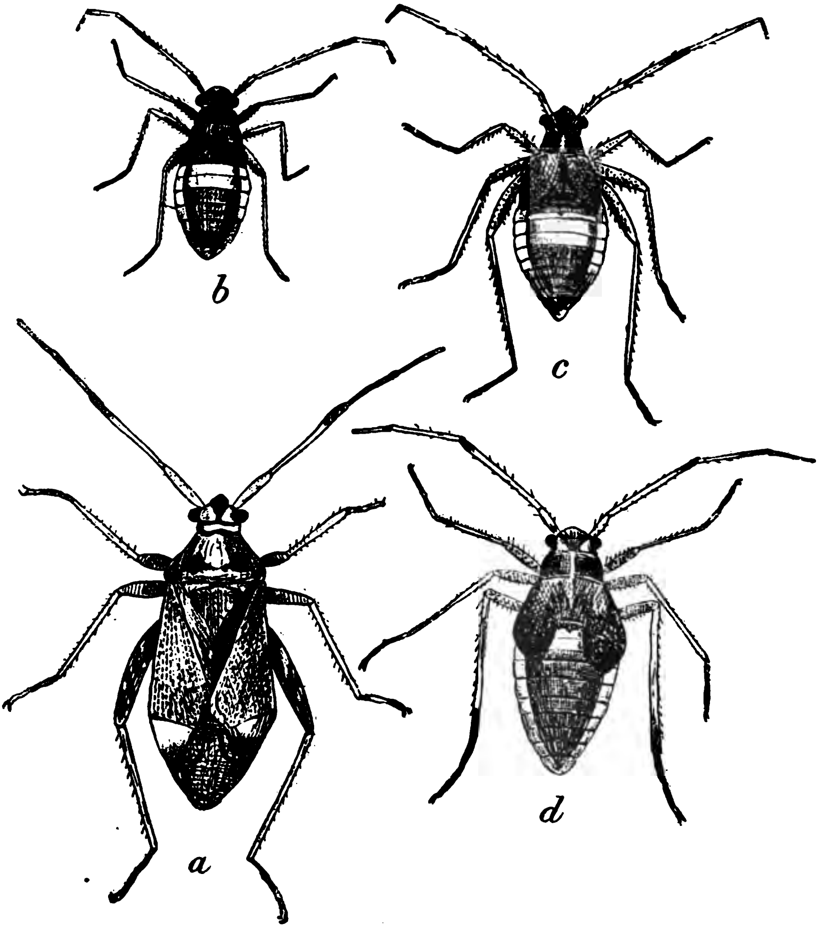


Fig. 69.—Needle-nose hop-bug (*Calocoris fulvomaculatus*): *a,* Adult; *b,* early stage of nymph; *c,* 4th instar nymph; *d,* 5th instar nymph. (Theobald.)

*Description and biology: Pupates* in the soil.
*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 406.

## B. OTHER IMPORTANT HOPS INSECTS.

### HEMIPTERA.

**Miridae (Capsidæ).**

*Calocoris fulvomaculatus:* Needle-nosed hop bug; Europe; sucks juices. (See text, fig. 69.)

COLEOPTERA.

**Chrysomelidæ.**

*Phyllotreta nemorum* Linnæus; Europe. (See Crucifers.)

**Elateridæ.**

*Agriotes lineatus* Linnæus. (See Tobacco.)

LEPIDOPTERA.

**Pyralidæ.**

*Pyrausta nubilalis* Hübner; Europe; bores in stems. (See Grain.)

**Noctuidæ.**

*Hypena rostralis* Linnæus; Europe; feeds on foliage.

LITERATURE.

THEOBALD, F. V. Text Book of Agric. Zoology, pp. 260–262, figs. 150, 159. 1913.
REMISCH, Fr. VON. Zeitschr. f. Wiss. Insekten biol., band. 13, heft 9, pp. 331–333; heft 10, pp. 363–368. 1908.

## HORNBEAM.

(*Carpinus betulus* L., etc. Family Betulaceæ.)

Hard-wooded trees much used in tool making. Occur in Europe, Asia, and America.

### IMPORTANT HORNBEAM INSECTS.

HEMIPTERA.

**Coccidæ:**

Unarmored—

*Pulvinaria betulæ* Linnæus; *Lecanium coryli* Linnæus, and *Lecanium pulchrum* Marchal; Europe.

COLEOPTERA.

**Anobiidæ.**

*Xestobium rufovillosum* DeGeer; Europe; bores in the wood.
*Ptilinus pectinicornis* Linnæus; Europe; bores in the wood.

**Elateridæ.**

*Athous subfuscus* Müller; wireworm; Europe; injures fruit and seedlings.

**Scarabæidæ.**

*Amphimallon solstitialis* Linnæus; Europe; the larvæ injure the roots of small plants while the adults injure the shoots.
*Melolontha hippocastani* Fabricius, and *M. melolontha* Linnæus; Europe; larvæ injure roots of seedlings.

**Scolytidæ.**

*Anisandrus dispar* Fabricius; Europe; galleries wood.
*Scolytus carpini* Ratzeburg; Germany; galleries in bark, bast, and sapwood.
*Xyloterus domesticus* Linnæus; Germany; galleries in bark and sapwood.

LEPIDOPTERA.

**Geometridæ.**

*Hibernia defoliaria* Linnæus and *H. marginaria* Borckh.; Europe; defoliators.

**Lymantriidæ.**

*Dasychira pudibunda* Linnæus; **Euproctis chrysorrhoea* Linnæus, **Lymantria monacha* Linnæus, **Porthetria dispar* Linnæus, *Porthesia similis* Fuessly; Europe; defoliators. (See Forest defoliators.)

LITERATURE.

LINDINGER, L. Die Schildläuse (Coccidæ). 1912.
HESS, R. Der Forstschutz, 1900, vol. 2.
NÜSSLIN, O. Leitfaden der Forstinsektenkunde, 2d ed. 1913.

## HORSE-CHESTNUT; BUCKEYE.

(*Aesculus* spp. Family Sapindaceæ.)

Ornamental trees and shrubs, desirable for shade trees, occurring in North America, Asia, Europe.

### A. HORSE-CHESTNUT INSECT LIKELY TO BE IMPORTED.

* **Zeuzera pyrina** Linnæus.

(Horse-chestnut Borer. Cossidæ; Lepidoptera.)

*Hosts:* Elm, alder, ash, beech, birch, horse-chestnut, linden, maple, oak, willow, poplar, buckthorn, spindle tree, mountain ash.

*Injury:* Bores in bark and wood of trees.

*Description and biology: Moth* white, with steel-blue round spots; wing expanse 50–70 mm. *Larva* yellowish, more flesh-colored when younger, with shining black, warts; head, thoracic shields and legs black. The larva bores in the wood and pupates in a cell of frass near the outside.

*Distribution:* Europe, North Africa, and introduced into North America.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 1913, 3d ed., vol. 3, p. 321.

Hess, Richard. Der Forstschutz, 1900, vol. 2, pp. 84, 85.

Nüsslin, Otto. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 321, 322, figs. 273–275.

### B. IMPORTANT HORSE-CHESTNUT INSECTS.

#### HEMIPTERA.

**Coccidæ.**

Unarmored—

*Lecanium coryli* Linnæus; Europe; *Aesculus hippocastanum, A. pavia.*

#### COLEOPTERA.

**Anobiidæ.**

*Xestobium rufovillosum* De Geer; Europe; bores in dead wood of standing and living trees.

**Bostrychidæ.**

*Sinoxylon perforans* Schr.; Europe; bores in branches.

**Scarabæidæ.**

*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus; Europe; larvæ injure roots of seedlings.

**Cerambycidæ.**

*Phymatodes lividus* Rossi; Germany; bores in wood of felled trees and lumber.

**Ipidæ.**

*Anisandrus dispar* Fabricius; Germany; galleries in wood.

#### LEPIDOPTERA.

**Geometridæ.**

*Anisopteryx æscularia* Schiffermiller; Europe; feeds on foliage.

#### LITERATURE.

Nüsslin, Otto. Leitfaden der Forstinsektenkunde, 2d ed., 1913.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.

## HORSE-RADISH.

(*Radicula armoracia.* Family Cruciferæ.)

An herb cultivated for its roots.

### IMPORTANT HORSE-RADISH INSECTS.

#### COLEOPTERA.

**Chrysomelidæ.**

*Phyllotreta nigripes* Fabricius, and *P. armoraciæ* Koch; Europe, North America. (See Crucifers.)

*Phyllotreta atra* Fabricius; Europe; flea beetle.

#### LEPIDOPTERA.

**Pyralidæ.**

*Pionea forficalis* Linnæus; Europe. (See Cabbage.)

## IRIS.

(*Iris* spp. Family Iridaceæ.)

Flowering herbs, propagated from roots.

### IRIS INSECTS.

DIPTERA.

**Syrphidæ.**

**Eumerus strigatus* Fallen, Europe, New York; attacks tubers. (See Onion.)

## JICACO; COCOA PLUM.

(*Chrysobalanus icaco*. Family Rosaceæ.)

A tropical plant introduced into Florida.

### JICACO INSECTS.

HEMIPTERA.

**Aleyrodidæ.**

*Aleurodicus cocois* Curtis; West Indies, Mexico, Central and South America. (See Coconut.)

DIPTERA.

**Trypetidæ.**

*Ceratitis giffardi* Bezzi; Africa; attacks fruit of *Chrysobalanus ellipticus*. (See Fruit.)
*Ceratitis silvestrii* Bezzi; Africa. (See Fruit.)

## JUNIPER; RED CEDAR.

(*Juniperus* spp. Family Juniperaceæ.)

Ornamental evergreen trees or shrubs distributed throughout the extratropical regions of the northern hemisphere. The wood is used in finishing interiors of houses, for posts, and the manufacture of small articles, especially pencils. The fruit of *J. drupacea* is edible. Aromatic oils used in medicine are obtained from the fruit and branches of some species.

### Eriophyes quadrisetus F. Thoms.

(Juniper blister mite. Eriophyidæ; Acarina.)

*Host: Juniperus communis.*

*Injury:* Causes deformations.

*Description and biology:* A four-legged blister mite which forms gall-like swellings of the fruit and needle. Very easy to introduce on nursery stock.

*Distribution:* Europe.

### INSECTS INJURIOUS TO JUNIPER.

HEMIPTERA.

**Coccidæ.**

Armored—

*Aspidiotus maderensis* Lindinger; Madeira; *Juniperus cedrus*.
**Chionaspis striata* Newstead; South Europe; *Juniperus drupacea, J. fœtidissima, J. macrocarpa, J. oxycedrus, J. phœnicea.*
*Cryptaspidiotus mediterraneus* Lindinger; Algeria, Greece; *Juniperus macrocarpa, J. phœnicea.*
*Diaspis atlantica* Lindinger; Canary Islands; *Juniperus phœnicea.*
*Diaspis visci* Schrank; Europe; *Juniperus canadensis, J. cedrus, J. chinensis, J. communis, J. drupacea, J. excelsa, J. macrocarpa, J. oxycedrus, J. phœnicea, J. recurva, J. sabina, J. sphærica, J. torulosa, J. virginiana.*
*Lepidosaphes juniperi* Lindinger; Anatolia; *Juniperus excelsa.*

Unarmored—

*Pseudococcus vovæ* Nassonow; Russia; Austria; *Juniperus communis.*

COLEOPTERA.

**Ipidæ.**

*Phlœosinus thujæ* Perris; Europe; *Juniperus communis.*

LEPIDOPTERA.

**Tortricidæ.**

*Laspeyresia duplicana* Zetterstedt; Europe. (See Conifers.)

BIBLIOGRAPHY.

LINDINGER, L. Die Schildläuse (Coccidæ). 1912.
EICHHOFF, W. Europ. Borkenkäfer. 1881.

## KAFIR CORN.

See Sorghum.

## KALE.

See Cabbage.

## KEI APPLE.

(*Aberia caffra.*)

A tree of Cape of Good Hope, introduced into California and Florida and quite hardy in southern California. A spring plant grown for hedges. The fruit is used as pickles or conserves.

### A KEI APPLE INSECT.

DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann. (See Fruit.)

## KOHL-RABI.

See Cabbage.

## KOLA; COLA.

(*Sterculia acuminata.* Family Sterculiaceæ.)

Tropical African trees cultivated for the nuts.

### A. KOLA INSECTS.

THYSANOPTERA.

* *Heliothrips rubrocinctus* Giard; West Indies, Ceylon, Uganda, Florida. (See Fruits.)

HEMIPTERA.

**Coccidæ.**

*Lecanium catori* Green; Algeria; on pods.

## LARCH.

(*Larix* spp. Family Pinaceæ.)

Valuable ornamental and forest trees grown in the colder regions of Europe, Asia, and North America. *L. decidua* (*europæa*), the European larch, yields turpentine and the bark contains tannin, used for tanning leather. For convenience the insect pests are arranged under Conifers.

## LETTUCE.

(*Lactuca* spp. Family Compositæ.)

A well-known genus of herbs grown for their edible foliage.

### IMPORTANT LETTUCE INSECTS.

COLEOPTERA.

**Elateridæ.**

*Agriotes lineatus* Linnæus. (See Tobacco.)

LEPIDOPTERA.

**Pyralidæ.**

* *Pionea ferrugalis* Hübner; Europe, Asia, North America. (See Cabbage.)

**Noctuidæ.**

*Mamestra brassicæ* Linnæus; Europe; feeds on leaves.

## LINDEN; BASSWOOD; LIME.

(*Tilia* spp. Family Tiliaceæ.)

Trees distributed generally throughout the northern temperate zone. The wood of several species is easily cut into veneers and is hence in much demand for light boxes for packing fruits, etc. They are valuable honey trees.

### A. LINDEN INSECTS LIKELY TO BE IMPORTED.

**Eriophyes tiliarius** Connold; **Eriophyes tiliæ** Nalepa.

(Linden Gall Mites. Eriophyidæ; Acarina.)

*Host*: *Tilia europaea.*

*Injury:* The first-mentioned mite forms galls on the flower bracts, and the second on the leaves, but neither is of vital importance.

*Distribution:* England.

Gillanders, A. T. Forest Entomology, 1908, pp. 27, 28, 30, 31, fig. 26.

### B. IMPORTANT LINDEN INSECTS.

HEMIPTERA.

**Coccidæ.**

Armored—

*Chionaspis salicis* Linnæus; Europe.

Unarmored—

*Lecanium coryli* Linnæus; Europe.

*Xylococcus filifer* Loew; Europe; *Tilia cordata, T. grandiflora.*

**Pyrrhocoridæ.**

*Pyrrhocoris apterus* Linnæus; Germany; in all stages sucks the juices from the leaves, fruit, and stems.

COLEOPTERA.

**Buprestidæ.**

*Agrilus viridis* Linnæus; Europe; bores in stems and branches. (See Oak).

*Lampra rutilans* Fabricius, and *L. undatus* Fabricius; Europe; bore in bark and wood.

**Scarabæidæ.**

*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus; Europe; larvæ injure roots of seedlings

**Ipidæ.**

*Ernoporus caucasicus* Lind.; bark beetle; Europe.

*Ernoporus tiliæ* Panzer; bark beetle; Europe; *Tilia parvifolia.*

*Xyloterus domesticus* Linnæus, and *X. signatus* Fabricius; ambrosia beetles.

LEPIDOPTERA.

**Cossidæ.**

*Cossus cossus* Linnæus, goat moth; Europe; bores in wood. (See Willow.)

**Zeuzera pyrina* Linnæus; Europe; bores in wood. (See Horse-chestnut.)

**Noctuidæ.**

*Xylina socia* Rott.; Europe. (See Plum.)

**Geometridæ.**

*Hibernia aurantiaria* Esp., *H. defoliaria* Linnæus, and *H. marginaria* Borckh.; Europe; defoliators.

**Lasiocampidæ.**

*Eriogaster lanestris* Linnæus; Germany; defoliator.

**Lymantriidæ.**

*Dasychira pudibunda* Linnæus, **Lymantria monacha* Linnæus, **Porthetria dispar* Linnæus, and *Porthesia similis* Fuessly; Europe; defoliators. (See Forest defoliators.)

### LITERATURE.

Nüsslin, Otto. **Leitfaden der Forstinsektenkunde, 2d ed., 1913.**
Hess, R. **Der Forstschutz, 1898, 1900.**
Lindinger, L. **Die Schildläuse (Coccidæ), 1912.**

## LOQUAT.

(*Eriobotrya japonica.* Family Rosaceæ.)

A fruit tree native of China and Japan, much planted in the Gulf States. The fruit occasionally reaches the northern markets.

### IMPORTANT LOQUAT INSECTS.

#### HEMIPTERA.

**Coccidæ.**
Unarmored—
*Ceroplastes vinsonii* Signoret; Mauritius; Reunion Island.

#### LEPIDOPTERA.

**Lycænidæ.**
*Virachola insocrates* Fabricius; India; bores in fruit. (See Fruit.)

**Pyralidæ.**
*Dichocrocis punctiferalis* Guénée; Queensland. (See Corn.)

#### DIPTERA.

**Trypetidæ.**
*Ceratitis capitata* Wiedemann, fruit fly. (See Fruit.)
*Bactrocera tryoni* Froggatt; Orient. (See Fruit.)

## MAHOGANY.

(*Swietenia mahogoni.* Family Meliaceæ.)

A tropical tree of great importance in the furniture trade, offered by nurserymen of Florida and California.

### IMPORTANT MAHOGANY INSECTS.

#### LEPIDOPTERA.

**Cossidæ.**
*Zeuzera coffeæ* Nietner; Orient. (See Coffee.)

**Pyralidæ.**
*Hypsipyla robusta* Moore; India; twig borer.

## MAIZE.

See Corn.

## MAMMEE APPLE.

(*Mammea americana.* Family Guttiferæ.)

Tropical fruit tree now cultivated in Florida and California.

### MAMMEE APPLE INSECTS.

#### DIPTERA.

**Trypetidæ.**
*Ceratitis capitata* Wiedemann. (See Fruit.)
*Dacus xanthodes* Broun; Fiji. (See Fruit.)

## MANGEL.

See Beet.

## MANGO.

(*Mangifera indica.* Family Anacardiaceæ.)

A much-cultivated fruit tree originating in the Orient and now extensively cultivated in the West Indies and also in Florida and California.

## A. BETTER KNOWN MANGO INSECTS LIKELY TO BE IMPORTED.

### **Psylla cistellata** Buckton.

(The Mango Shoot Psylla. Psyllidæ; Hemiptera.)

*Host:* Mango (*Mangifera indica*).

*Injury:* Injures terminal shoots by producing imbricated pseudo-cones of a bright green or yellow color in which the larval and pupal stages are passed.

*Description: Adult* head small, eyes globose and prominent; abdomen deeply corrugated and ringed; general color of body shining pitchy black.

*Distribution:* India.

Buckton, G. B. Indian Museum Notes, 1896, vol. 3, No. 2, p. 91.

### **Dinoderus distinctus** Lesne.

(Bostrychidæ; Coleoptera.)

*Hosts:* Mango, bamboo.

*Injury:* Infests branches.

*Description: Adult* brown, with reddish tinge at base of elytra. Marginal teeth of prothorax very small, the two middle ones longest. Length 3.5 mm. (See text fig. 70.)

*Distribution:* India.

Maxwell-Lefroy, H. Indian Insect Life, 1909, p. 316.

Stebbing, E. P. Indian Forest Insects, 1914, pp. 129, 130.

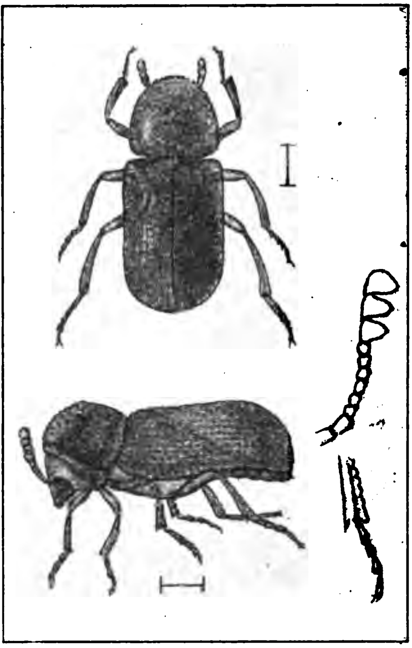


Fig. 70.—Mango and bamboo borer (*Dinoderus distinctus*): Adults. (Maxwell-Lefroy.)

### **Plocæderus ruficornis** Newman.

(The Mango Bark Borer. Cerambycidæ; Coleoptera.)

*Host:* Mango.

*Injury:* Considered one of the most formidable pests of the Philippine Islands.

*Description and biology: Adult* beetle 23 to 45 mm. in length with antennæ longer than body; body dull blackish in color, antennæ reddish brown, thorax with sharp spine on each side, legs of same rufous color as antennæ. Eggs deposited singly on the bark or in crevices of wounds near lower part of the trunk. *Larvæ* on hatching bore into the inner part of bark, where the entire grub stage is passed; *pupate* in a cavity made of grass. (See plate xxx.)

*Distribution:* Philippine Islands.

Jones, C. R. The Philippine Agric. Review, 1913, vol. 6, No. 3, pp. 118–124, pls. 24.

### **Sternochetus gravis** Fabricius. (**Cryptorhynchus**).

(Northern Mango Weevil. Curculionidæ; Coleoptera.)

*Host:* Mango.

*Injury:* This is the common mango weevil of Northern India, and is liable to be introduced in seed.

*Description and biology: Adult* weevil rusty brown to blackish brown, mottled with grayish patches; length 9 mm. Beak long. The entire development takes place in the fruit, the larvæ first feeding in the pulp, then entering the seed. (See text fig. 71.)

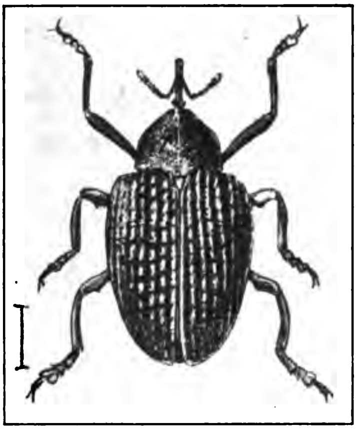


Fig. 71.—Northern mango weevil (*Sternochetus gravis*): Adult. (Maxwell-Lefroy.)

*Distribution:* India (Bengal, Assam, United Provinces).

Stebbing, E. P. Indian Forest Insects, Coleoptera, p. 436, fig. 289.

**Sternochetus mangiferæ** Fabricius.
**(Cryptorhynchus.)**

(Mango Weevil. Curculionidæ; Coleoptera.)

*Host:* Mango.

*Injury:* Serious enemy of mango, especially in Hawaii, where it is reported to have infested from 60 to 90 per cent of the crop. Liable to be introduced in seed.

*Description and biology: Adult weevil,* varies from 6 to 8 mm. in length; when nearly developed whitish pink in color, later changing to a dark brown with yellow markings; beak short, thick, and when at rest turned back beneath the thorax in a groove terminating between the first pair of legs. The egg is deposited in the fleshy part of the fruit, and on hatching the larva enters the seed, where it undergoes its entire development, vacating as an adult.

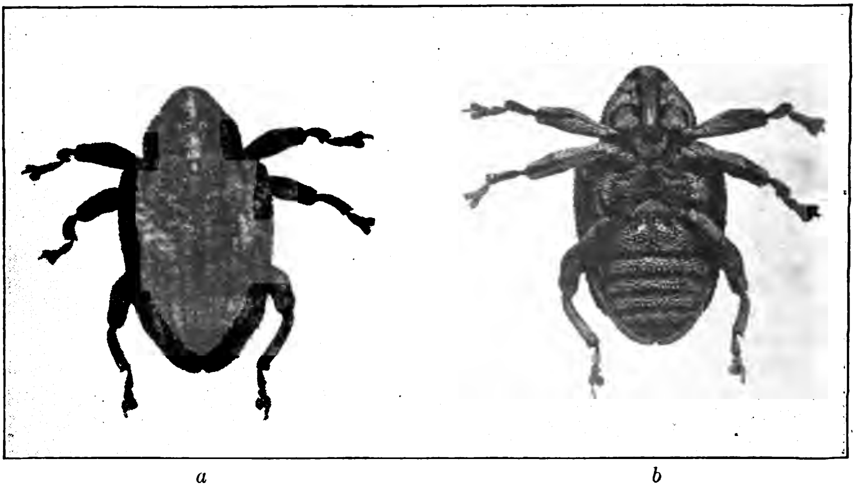
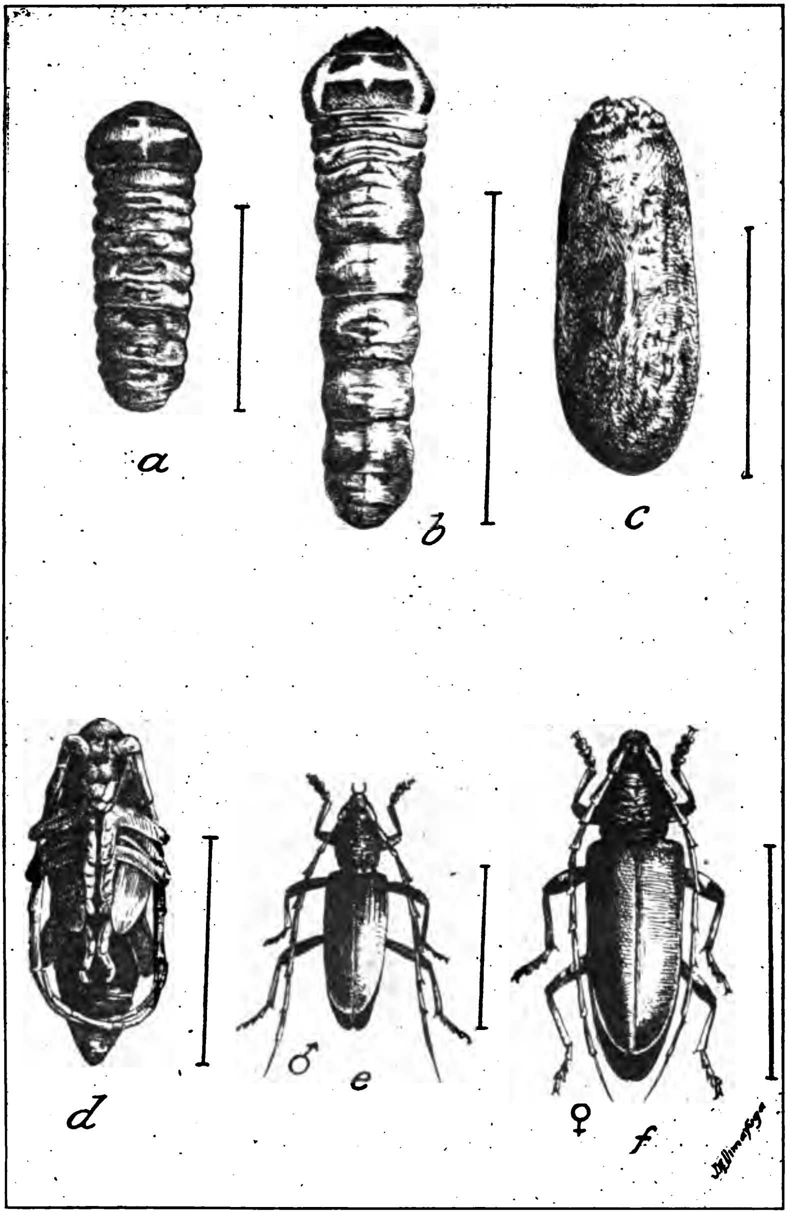


Fig. 72.—The mango weevil (*Sternochetus mangiferæ*): *a*, Adult weevil, from above; *b*, same, from below. Much enlarged. (Marlatt.)

*Distribution:* Inhabits all mango regions bordering Indian Ocean, East Indies including Philippines, Madagascar, Hawaii, Labuan, Straits Settlements, and South Africa. (Text figs. 72, 73.)

Van Dine, D. L. Agr. Exper. Sta. Hawaii, Press Bul. 17, 1906.
Marlatt, C. L. U. S. Dept. Agr., Bur. Entom., Circ. 141, 1911.



A DESTRUCTIVE MANGO INSECT.

Mango bark borer (*Plocæderus ruficornis*). *a*, *b*, Larvæ; *c* ,cocoon; *d*, pupa; *e*, male;  , female. (Jones.)

### **Dacus rarotongæ** Froggatt.

(Raratonga Fruit Fly. Trypetidæ; Diptera.)

*Host:* Mango.

*Injury:* Larvæ feed in fruit.

*Description:* Adult female length 9 mm., thorax shining black; wings hyaline; abdomen diamond shaped; anal segment and ovipositor yellow.

*Distribution:* Raratonga, Cook Islands.

Froggatt, W. W. Proc. Linn. Soc. New South Wales, 1910, vol. 35, pt. 4, p. 872.

### **Dacus tongensis** Froggatt.

(Tonga Fruit Fly. Trypetidæ; Diptera.)

*Host:* Mango.

*Injury:* Bred from mangos imported into New Zealand.

*Description:* Adult female length 9 mm.; head dull yellow; thorax black, no yellow on shoulders; wings hyaline, nervures chocolate brown; abdomen black, elongate, oval; legs light yellow, sometimes clouded at apex of femora.

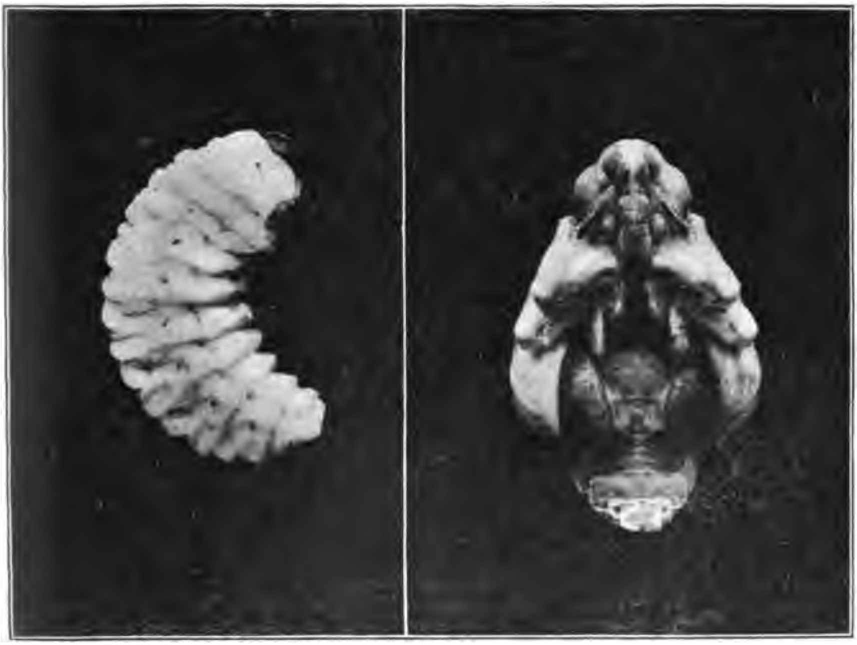


Fig. 73.—The mango weevil (*Sternochetus mangiferæ*): *a*, Larva; *b*, pupa. Much enlarged. (Marlatt.)

*Distribution:* Tonga.

Froggatt, W. W. Proc. Linn. Soc. New South Wales, 1910, vol. 35, pt. 4, p. 870.

## B. IMPORTANT MANGO INSECTS.

### HEMIPTERA.

**Coccidæ:**

Armored—

- *Aspidiotus (Chrysomphalus) personatus* Comstock; West Indies, Mexico. (See Olive.)
- *Aspidiotus (Morganella) longispina* Morgan; Hawaii, Mauritius; scale of adult female less than 1 mm. wide, circular, flattened with reddish nipple-like exuvium.

**Coccidæ**—Continued.

Armored—Continued.

*Aspidiotus* (*Morganella*) *maskelli* Cockerell; Hawaii, Mauritius, Brazil; scale of female about 1 mm. in diameter, pitch black exuvia concolorous and to one side.

∗ *Aspidiotus* (*Pseudaonidia*) *articulatus* Morgan; British West Indies. (See Coffee.)

*Aspidiotus* (*Pseudaonidia*) *clavigera* Cockerell; Hawaii. (See Citrus.)

*Aspidiotus* (*Pseudaonidia*) *trilobitiformis* Green; German East Africa, Java. (See Citrus.) (See text fig. 32.)

*Aspidiotus* (*Pseudischnaspis*) *longissima* Cockerell; Mexico; scale of female 2.5 mm. long by 0.66 mm. broad, black marked with brown, ventral scale thin, white, exuvia to one side.

*Aulacaspis cinnamomi* Newstead; Java, Ceylon; scale of adult female 1.25 mm. long, 1.75 mm. broad circular, flat, thin, opaque, white.

*Chionaspis vitis* Green; India; scale of adult female 2.5 mm. long, 2.5 mm. wide, white, thin, transparent.

∗ *Leucaspis indica* Marlatt; has been imported from India and is now established in certain sections of Florida. Scale of female white, elongate narrow, convex, flattened at tip; adult inclosed within swollen strongly chitinized second stages. (See plate I, fig. 1.)

∗ *Parlatoria pseudaspidiotus* Newstead; has been found on mangos imported from India, also reported from Singapore. Scale of female 1.5 mm. long, 1.25 mm. broad, dark brown, usually with slight apical extension.

*Chionaspis* (*Phenacaspis*) *dilatata* Green; Ceylon; scale of female 2 mm. in length, 1.5 mm. in breadth, snow white, opaque, with irregular raised lines on dorsal surface.

*Chionapsis eugeniæ* Maskell; Orient; scale of female 2.5 mm. long, white, elongate pyriform and flat.

*Chionaspis* (*Phenacaspis*) *natalensis* Cockerell; Natal; scale of female pyriform, about 3 mm. long, white with exuviæ pale orange brown, scale of male feebly tricarinate.

Unarmored—

*Ceroplastes rubens* Maskell; Australia, Hawaii, Japan. (See Avocado.)

*Ceroplastes vinsonii* Signoret; Mauritius; female covered with wax and resembles *C. rusci.*

*Coccus acuminatus* Signoret; Hawaii, Ceylon; adult female 3–3.25 mm. in length, flat pale green, acuminate at cephalic extremity and broadly rounded posteriorly.

*Coccus acutissimus* Green; Ceylon; adult female 5–6 mm. long, 1–1.5 mm. broad, long and narrow; acutely pointed at each end; color varying from creamy white to deep chocolate brown in older specimens.

∗ *Coccus mangiferæ* Green; West Indies, Ceylon; adult female 3–4 mm. in length, 2.5–3.5 mm. in breadth deltoid, pale yellowish green. Has been introduced into Florida and gives promise of being a serious pest.

*Geococcus radicum* Green; Ceylon, Hawaii; liable to be introduced on roots. Adult female inclosed in a brittle white sac, broadly fusiform, narrow at both extremities; antennæ 6-jointed.

*Icerya minor* Green; Bengal; adult female 4–6 mm. in length, yellow, with 22 or 23 waxy patches around body and a dorsal patch of about 16.

*Icerya seychellarum* Westwood; Seychelles. (See Citrus.)

*Phenacoccus iceryoides* Green; India, Philippines; adult female usually to be found at anterior extremity of a globose ovisac, margin with conspicuous fringe of white waxy tissues.

*Phenacoccus mangiferæ* Green; Ceylon, India; female pale yellow, dorsal area covered with white mealy powder, with stout white processes on margin.

*Pulvinaria ficus* Hempel; Brazil.

*Pulvinaria mammeæ,* Maskell; Hawaii; adult female reddish brown covered with thin grayish meal, ovisac large, snow white, forming a mass of loose cotton.

*Saissetia psidii* Green; Ceylon; adult female bright red to deep brown, length 2.5–3.75 mm.

*Saissetia punctilifera* Green; Ceylon; adult female 3–3.75 mm. long, 2–2.5 mm. broad, irregularly oval, narrowed in front, varying from reddish green to reddish ochreous.

*Vinsonia stellifera* Westwood; Ceylon. (See Coffee.)

## THYSANOPTERA.

∗ *Heliothrips rubrocinctus* Giard; West Indies, Ceylon, Uganda, Florida. (See Fruit.)

## COLEOPTERA.

**Cerambycidæ.**

*Epepeotes luscus* Fabricius; Java; bark borer.

*Batocera titana* Thomson; India; bores in sapwood. (See text fig. 74.)

**Brachyrhinidæ.**

*Diaprepes abbreviatus* Linnaeus; West Indies. (See Sugar cane.)

**Curculionidæ.**

*Cytorhynchus frigidus* Fabricius; India; breeds in fruit.

## LEPIDOPTERA.

**Notodontidæ.**

*Stauropus alternus* Walker; India, Ceylon, Java; defoliator.

DIPTERA.

**Trypetidæ.**

- *Anastrepha fraterculus* Wiedemann. (See Fruit.)
- *Dacus passifloræ* Froggatt; Fiji. (See Fruit.)
- *Dacus persicæ* Rig; India. (See Fruit.)
- *Dacus ferrugineus* Fabricius; India. (See Fruit.) (See fig. 75.)
- *Dacus diversus* Coquillett; India. (See Fruit.)
- *Bactrocera tryoni* Froggatt; Orient. (See Fruit.)
- *Bactrocera zonatus* Saunders; fruit fly; Solomon Islands, Ceylon, India.
- *Ceratitis capitata* Wiedemann. (See Fruit.)
- *Ceratitis punctata* Wiedemann; Africa. (See Fruit.)

LITERATURE.

Froggatt, W. W. Proc. Linn. Soc. New South Wales, 1910, vol. 35, pt. 4, pp. 868–870.
Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.

## MAPLE.

(*Acer* spp. Family Aceraceæ.)

A large genus of trees and shrubs occurring in Europe, Asia, and America, much prized for cultivation as shade trees and valuable for lumber.

### IMPORTANT MAPLE INSECTS.

ACARINA.

**Eriophyidæ.**

- *Eriophyes macrochelus* Nalepa; blister mite; England; attacks leaves of *Acer campestre*.

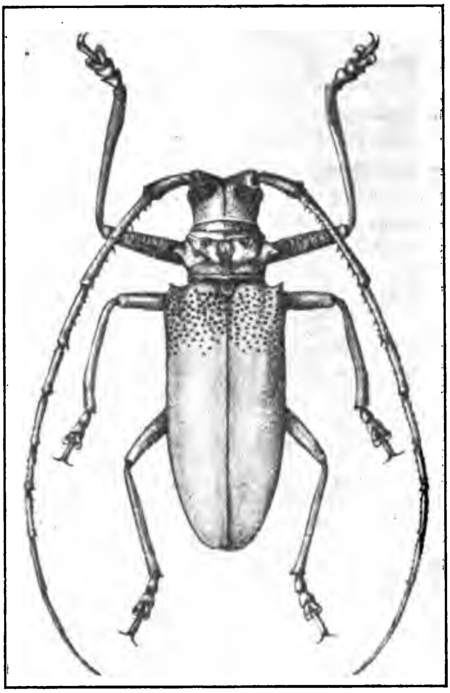


Fig. 74.—Mango borer (*Batocera titana*): Male. (Stebbing.)

HEMIPTERA.

**Coccidæ.**

Armored—

- *Chionaspis salicis* Linnæus; Europe; *Acer campestre* and *A. pseudoplatanus*.

Unarmored—

- *Eriococcus aceris* Signoret; Europe; *Acer campestre, A. pseudoplatanus.*
- *Lecanium aceris* Curtis; Europe.
- *Lecanium coryli* Linnæus; Europe; *Acer campestre, A. negundo, A. platanoides, A. pseudoplatanus.*
- *Palæococcus fuscipennis* Burmeister; Europe.

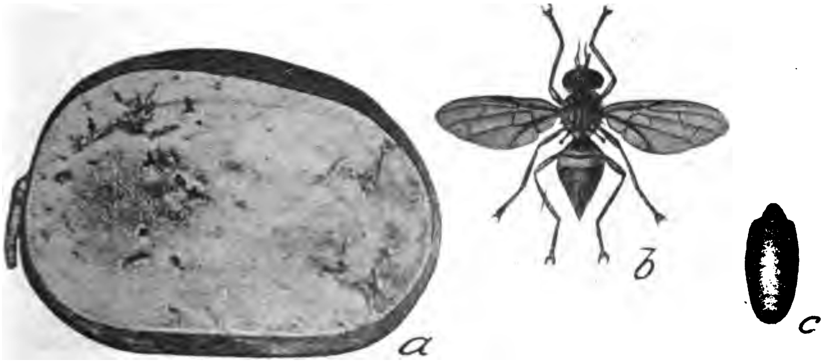


Fig. 75.—Mango fruit fly (*Dacus ferrugineus*): *a*, Injured mango; *b*, adult, and *c*, larva. (Maxwell-Lefroy.)

COLEOPTERA.

**Anobiidæ.**

*Xestobium rufovillosum* DeGeer; Europe; bores in trunks.
*Ptilinus pectinicornis* Linnæus; Europe; bores in trunks.

**Lymexylonidæ.**

*Hylecœtus dermestoides* Linnæus; Germany; bores in wood.

**Buprestidæ.**

* *Agrilus viridis* Linnæus; Europe; bores in stems and branches. (*See* Oak.)

**Scarabæidæ.**

*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus; Europe; injure roots of seedlings.

**Cerambycidæ.**

*Rhopalopus insubricus* Germar; Europe; bores in bark and wood.

**Scolytidæ, Ipidae.**

*Scolytus aceris* Knotek; Bosnia; galleries in bark and sapwood.
*Anisandrus dispar* Fabricius; Germany; ambrosia beetle in wood.
*Xyloterus domesticus* Linnæus and *X. signatus* Fabricius; ambrosia beetle Germany.

LEPIDOPTERA.

**Cossidæ.**

*Cossus cossus* Linnæus; Europe; bores in wood. (*See* Willow.)
* *Zeuzera pyrina* Linnæus; Europe; bores in wood. (*See* Horse-chestnut.)

**Geometridæ.**

*Cheimatobia brumata* Linnæus; Europe; defoliator.

**Lymantriidæ.**

*Dasychira pudibunda* Linnæus, * *Euproctis chrysorrhœa* Linnæus, * *Lymantria monacha* Linnæus, * *Porthetria dispar* Linnæus, and *Porthesia similis* Fuessly; Europe; defoliators. (*See* Forest defoliators.)

**Nepticulidæ.**

*Nepticula sericopeza* Zeller; Germany; attacks leaves and seed.

LITERATURE.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
NÜSSLIN, O. Leitfaden der Forstinsektenkunde, 2d ed., 1913.
HESS, R. Der Forstschutz, 1898, 1900.
LINDINGER, L. Die Schildläuse (Coccidæ), 1912.

## MELON.

(*See* Cucurbits.)

## MESQUITE; ALGAROBA.

(*Prosopis* spp. Family Leguminosæ.)

Tender trees and shrubs growing in arid regions. Several species are native in the Southwestern United States. The pods are eaten by cattle.

### IMPORTANT MESQUITE INSECTS.

HEMIPTERA.

**Coreidæ.**

*Ceratopachys variabilis* Dall., a sucking bug; India; sucks juices of jhand (*Prosopis spicigera*).

COLEOPTERA.

**Bostrychidæ.**

*Sinoxylon crassum* Lesne and *S. anale* Lesne; India; bores in *Prosopis spicigera.*

LITERATURE.

STEBBING, E. P. A Manual of Forest Zoology for India, 1908.
STEBBING, E. P. Indian Forest Insects, Coleoptera, 1914.

## MILLET.

(*Panicum miliaceum* Linnæus. Family Gramineæ.)

These are numerous varieties and species of millets grown throughout the world. This species is cultivated extensively in China, Japan, and Russia. The main danger of importing pests in shipments of seed. Its pests are discussed under Grains and Grasses.

## MOUNTAIN ASH; ROWAN TREE.

(*Sorbus* spp.)

Ornamental deciduous trees of the Northern Hemisphere, with small red berries. The berries of some species are edible, and the wood is used for tool handles and similar small articles.

### IMPORTANT MOUNTAIN-ASH INSECTS.

COLEOPTERA.

**Scarabæidæ.**

*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus; Europe; larvæ injure roots of seedlings.

**Curculionidæ.**

*Magdalis barbicornis* Latreille; Europe; breeds under bark.

**Scolytidæ, Ipidæ.**

*Scolytus mali* Bechst. and *S. rugulosus* Ratzeburg Europe; bark beetles.
*Xyloterus domesticus* Linnæus; Germany; Ambrosia beetle.

LEPIDOPTERA.

**Cossidæ.**

* *Zeuzera pyrina* Linnæus; Europe; bores in wood. (See Horse-chestnut.)

**Geometridæ.**

*Hibernia defoliaria* Linnæus; Europe; defoliator.

**Lymantriidæ.**

* *Lymantria monacha* Linnæus, **Orgyia antiqua* Linnæus, and *Porthesia similis* Fuessly; Europe defoliators. (See Forest defoliators.)

**Hyponomeutidæ.**

* *Argyresthia conjugella* Zeller; Europe, Japan, British Columbia; bores in fruit. (See Apple.)

HYMENOPTERA.

**Tenthredinidæ.**

*Nematus septentrionalis* Linnæus; Europe; sawfly.
*Priophorus padi* Linnæus; Europe. (See Plum.)

**Callimomidæ.**

*Megastigmus brevicaudus* Ratzeburg, a chalcid; Europe; breeds in seed.

LITERATURE.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.

## MOUNTAIN EBONY.

(*Bauhinia racemosa*, etc. Family Leguminosæ.)

Very showy plants of the Tropics. Many species are imported into Florida and California.

### IMPORTANT BAUHINIA INSECTS.

COLEOPTERA.

**Mylabridæ (Bruchidæ).**

*Caryoborus gonagra* Fabricius; India; Breeds in the pods of *Bauhinia racemosa*.

LITERATURE.

STEBBING, E. P. Indian Forest Insects, Coleoptera, 1914.

## MULBERRY.

(*Morus* spp. Family Moraceæ.)

Trees of the temperate regions of the Old and New World. Some species produce delicious fruit, while others are cultivated for hedges or as food for silk worms.

### IMPORTANT MULBERRY INSECTS.

HEMIPTERA.

**Coccidæ:**
Unarmored—
*Ceroplastes rusci* Linnæus; Italy.
*Guérinlella serratulæ* Fabricius; Italy.

COLEOPTERA.

**Cerambycidæ.**
*Apriona germari* Hope and *A. cinerea* Chevrolat; India; bore in stems of *Morus indica.*

LEPIDOPTERA.

**Geometridæ.**
*Hemirhopala atrilineata* Butler; Japan; defoliator.
*Zamacra albofasciaria* Leech; Japan; defoliator.

LITERATURE.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
STEBBING, E. P. Indian Forest Insects, Coleoptera, 1914.

## MUSKMELON.

(See Cucurbits.)

## NARCISSUS; DAFFODIL.

(*Narcissus* spp. Family Amaryllidaceæ.)

Flowering plants propagated from the bulbs.

### NARCISSUS INSECTS.

**Merodon clavipes** Fabricius; ✳ **Merodon equestris** Fabricius.

(Narcissus Flies. Syrphidæ; Diptera.)

*Hosts:* Narcissus, daffodil.
*Injury:* Breeds in the bulbs.
*Description and biology:* *M. clavipes* black, clothed with white, yellow, red, or black hairs. ✳ *M. equestris* black or dark metallic green, similarly clad; 13 mm. long. *Maggot* grayish yellow, 12 mm. long.
*Distribution:* Europe. Have been introduced into Canada, California and New Zealand.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 435.

## OAK.

(*Quercus* spp. Family Cupuliferæ.)

Valuable timber trees of the northern hemisphere. The bark of certain species yields cork, while of other species it is valuable for medicinal or tanning purposes.

### A. BETTER KNOWN OAK INSECTS LIKELY TO BE IMPORTED.

✳**Agrilus viridis** Linnæus.

(Flat-Headed Wood Borer. Buprestidæ; Coleoptera.)

*Hosts:* Oak, beech, alder, aspen, linden, birch, rose, grape, maple, pine.
*Injury:* Bores in stems and branches of trees.

*Description and biology: Beetle* 5–8 mm. long, of variable color (olive green, blue green, blue, coppery, etc.), undersides black. Prothorax much broader than long, with median impression. *Larva* with first thoracic segment strongly broadened, body white. A generation requires two years.

*Distribution:* Europe (Austria, Germany). Introduced into eastern United States in roses.

HESS, RICHARD. Der Forstschutz, 1900, vol. 2, pp. 7, 8, figs. 2, 3.

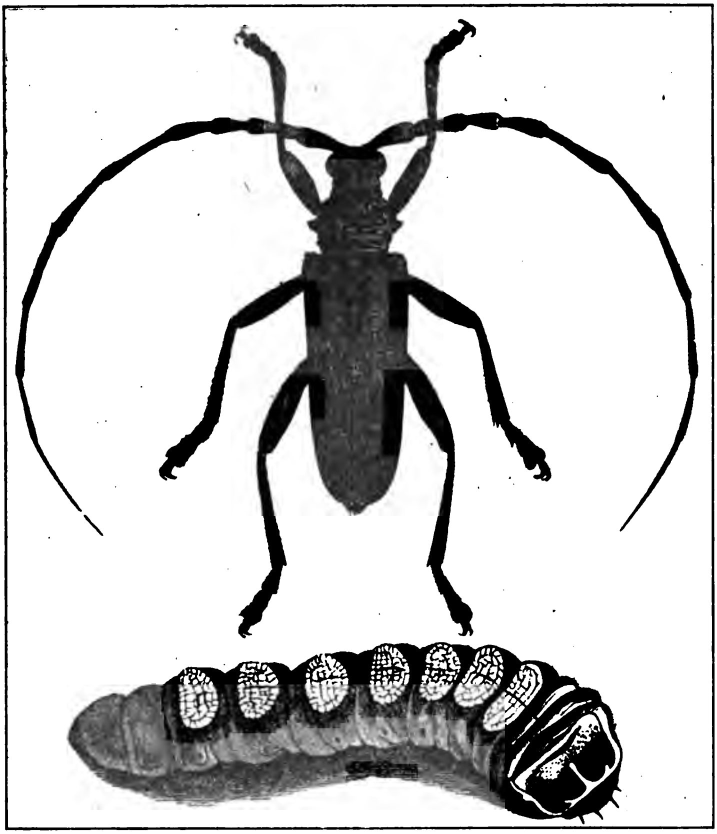


FIG. 76.—Great oak-borer (*Cerambyx cerdo*): Adult and larva. (Nüsslin.)

### **Cerambyx cerdo** Linnæus.

(Great Oak Borer. Cerambycidæ; Coleoptera.)

*Hosts:* Oak, cork oak, ash, walnut.
*Injury:* Bores in wood. (See text fig. 76.)
*Distribution:* Europe, Sudan, Tunis.

NÜSSLIN, OTTO: Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 145–148, figs. 115, 116.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 495–496.

### **Haltica quercetorum** Foudr.

(Oak Flea Beetle. Chrysomelidæ. Coleoptera.)

*Hosts:* Oak, hazel, willow, birch, tea rose, beech, alder.

*Injury:* Feed on foliage and buds in adult and larval stage.

*Distribution:* Europe (Russia, Germany).

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 523.

### **Cnethocampa processiona** Linnæus.

(Oak Procession Moth. Cnethocampidæ; Lepidoptera.)

*Host:* Oak.

*Injury:* Defoliator; serious.

*Description and biology:* *Moth,* body clad with long hairs; forewings yellow gray with dark gray cross band; hindwings yellowish white with brown gray cross band. *Larva* gray blue with dark dorsal stripe and reddish-brown smooth spots; undersides light greenish gray. Feeds at night. In the daytime the larvæ wander in processions of a few files. *Pupation* takes place in thick oval brown cocoon. *Eggs* are laid in clusters of 100 to 200, covered with scales from the parent, and placed on smooth spots of the bark.

*Distribution:* Europe.

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 326–328, figs. 280, 281.

### **Coleophora lutipennella** Zell.

(Oak Bud Moth. Elachistidæ; Lepidoptera.)

*Host:* Oaks and possibly birch.

*Injury:* Attacks the buds.

*Description and biology:* *Adult,* moth, wing expanse 15 mm., with front wings yellow, hind wings gray, all fringed. *Larva,* gray with black head. Attacks especially the axillary buds. *Pupates* in a sack or case.

*Distribution:* Germany.

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913, p. 433.

### **Tortrix viridana** Linnæus.

(Green Oak Tortrix. Tortricidæ; Lepidoptera.)

*Hosts:* *Quercus pedunculata, Q. sessiliflora, Castanea vulgaris.*

*Injury:* Feeds on the buds, foliage, and inflorescence.

*Description and biology:* *Moth,* wing expanse 18–22 mm., forewings brilliant green with yellowish border, hind wings gray. *Larva,* dirty green, punctured with black, with black head, 15 mm. long. *Eggs* are laid on the buds. The larva rolls the leaves, in which it feeds.

*Distribution:* Europe.

HESS, RICHARD. Der Forstschutz, 1900, vol. 2, pp. 128–130, figs. 66, 67.

NÜSSLIN, OTTO. Leitfaden der Forstinsektenkunde, 2d ed., 1913, pp. 403, 404, fig. 332.

## B. IMPORTANT OAK INSECTS.

### HEMIPTERA.

**Aphididæ.**

*Pterochlorus exsiccator* Altum, *Stomaphis longirostris* Altum, and *S. quercus* Linnæus, plant lice; Europe; attack the bark, especially of the roots.

**Coccidæ.**

Armored—

*Aspidiotus* (*Targionia*) *alni* Marchal; Austria; *Quercus cerris.*

*Aspidiotus* (*Targionia*) *distincta* Leonardi; Italy; *Quercus robur, Q. suber.*

*Aspidiotus* (*Targionia*) *vitis* Signoret; Italy, Sardinia; *Quercus macedonica, Q. suber.*

*Aspidiotus minimus* Leonardi; Europe; *Quercus coccifera, Q. ilex, Q. suber.*

*Aspidiotus* (*Diaspidiotus*) *zonatus* Frauenfeld; Europe; *Quercus cerris, Q. lusitanica, Q. montana, Q. nigra, Q. palustris, Q. pubescens, Q. robur, Q. sessiliflora.*

*Chionaspis salicis* Linnæus; Europe; *Quercus ilex, Q. robur.*

**Coccidæ**—Continued.

Unarmored—

* *Asterolecanium variolosum* Ratzeburg; Eastern United States, Europe; *Quercus branti*, *Q. cerris*, *Q. ilex*, *Q. macedonica*, *Q. palustris*, *Q. prinus*, *Q. pubescens*, *Q. robur*, *Q. sessiliflora*, *Q. toza*, *Q. castaneifolia*, *Q. coccifera*.

*Eriococcus aceris* Signoret; Austria; *Quercus sessiliflora*.

*Kermes bacciformis* Leonardi; Europe; *Quercus cerris*, *Q. suber*.

*Kermes ballotæ* Signoret; Algeria, France; *Quercus ilex ballota*.

*Kermes cordiformis* Lindinger; Austria; *Quercus robur*.

*Kermes gibbosus* Signoret, Austria; *Quercus cerris*.

*Kermes ilicis* Linnæus; Europe; *Quercus coccifera*, *Q. ilex*.

*Kermes pallidus* Signoret; Europe.

*Kermes roboris* Fourcroy; Europe; *Quercus cerris*, *Q. ilex*, *Q. pedunculata*, *Q. robur*, *Q. sessiliflora*.

*Kermes vermilio* Planchon; Europe; *Quercus coccifera*.

*Lecanium ciliatum* Douglas; Europe; *Quercus robur*.

*Lecanium coryli* Linnæus; Europe; *Quercus coccifera*, *Q. ilex*, *Q. robur*, *Q. sessiliflora*, *Q. suber*.

*Lecanium pulchrum* King; Europe.

*Nidularia pulvinata* Planchon; France, Algeria; *Quercus coccifera*, *Q. ilex*.

*Palæococcus fuscipennis* Burmeister; Denmark; *Quercus robur*.

*Pulvinaria sericea* Fourcroy; Europe; *Quercus pubescens*.

## COLEOPTERA.

**Anobiidæ.**

*Xestobium rufovillosum* De Geer; Europe; bores in dead wood.

*Ptilinus pectinicornis* Linnæus; Europe; bores in the wood, injuring it for technical purposes.

**Lyctidæ.**

*Lyctus linearis* Goeze; Europe, South America; bores in seasoned lumber, especially in sapwood, also in barrel staves.

**Bostrychidæ.**

*Bostrychus capucinus* Linnæus; Europe; bores in lumber and barrel staves.

*Sinoxylon perforans* Schr.; Europe; bores in the branches.

**Lymexylonidæ.**

*Hylecœtus dermestoides* Linnæus; Europe; bores in wood.

*Lymexylon navale* Linnæus; Europe; bores in the bark and wood.

**Tenebrionidæ.**

*Phylan gibbus* Fabricius, Russia; injures the roots of seedlings.

**Scarabæidæ.**

*Euchirus macleayi* Ho.; India; bred from oak stem.

**Buprestidæ.**

*Agrilus angustulus* Illiger, *A. elongatus* Herbst, *A. subauratus* Gebler, *A. biguttatus* Fabricius; Europe; bore in bark, bast, and sapwood.

*Chrysobothris affinis* Fabricius; Europe; bores in bast and sapwood of branches and in trunks of seedlings.

*Coræbus elatus* Fabricius, *C. fasciatus* Villers, *C. undatus* Fabricius; Europe; attack the stems and branches, especially of cork oaks.

**Elateridæ.**

*Agriotes aterrimus* Linnæus, *A. lineatus* Linnæus, and *A. obscurus* Linnæus, *Athous subfuscus* Müller; *Dolopius marginatus* Linnæus; *Lacon murinus* Linnæus; *Limonius æruginosus* Olivier; *Prosternon holosericeus* Olivier; *Selatosomus æneus* Linnæus; wireworms; Europe; injurious to acorns and seedlings.

**Scarabæidæ.**

*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus; Europe; larvæ injures roots of seedlings.

**Cerambycidæ.**

*Callidium æneum* DeGeer; Germany; bores in wood of felled trees and lumber.

*Cerambyx cerdo* Linnæus; Europe; bores in bark and wood.

*Clytus tropicus* Panzer; Germany; bores in wood.

*Pyrrhidium sanguineum* Linnæus, and *Phymatodes testaceus* Linnæus; Germany; bore in wood of felled trees and lumber.

*Phymatodes lividus* Rossi; Germany; particularly injurious to barrel hoops and lumber.

*Lophosternus hugeli* Redtenbacher; India; bores in trunks of *Quercus incana*.

*Paraphrus granulosus* Thomson; India; bores in *Quercus ilex*.

*Prionus corpulentus* Bates; India; probably bores in *Quercus semicarpifolia*.

*Massicus unicolor* Gahan; India; bores in heartwood of *Quercus griffithii*.

*Xylotrechus stebbingi* Gahan; India; bores in bast and outer sapwood of *Quercus dilatata*.

*Meges marmoratus* Westwood; India; on *Quercus griffithii*.

**Brachyrhinidæ.**

*Brachyderes lusitanicus* Fabricius; Europe; attacks roots of *Quercus robur*, etc.
*Metallites iris* Olivier; Europe; breeds at the roots.

**Curculionidæ.**

*Curculio nucum* Linnæus (*Balaninus*); Europe (see Hazel). Many other spp. *Curculio* (*Balaninus*)

**Calendridæ.**

*Calendra sculpturata* Gyllenhal; India, breeds in the acorns.

**Scolytidæ, Ipidæ.**

*Anisandrus dispar* Fabricius; Europe; galleries in wood.
*Dryocoetes hewetti* Stebbing; India; bores in *Quercus dilatata* and *Q. incana*.
*Dryocoetes villosus* Fabricius; Germany; galleries in bark.
*Hylesinus crenatus* Fabricius; Germany; galleries in bark.
*Chramesus globulus* Stobbing; India; bark and wood of *Quercus incana*.
*Scolytus intricatus* Ratzeburg; Europe; galleries in bark.
*Xyleborus dryographus* Ratzeburg and *X. monographus* Fabricius; Europe; galleries in wood.
*Xyleborus improbus* Sampson; India; tunnels *Quercus lamellosa*.
*Xyloterus domesticus* Linnæus, and *X. signatus* Fabricius; Europe; galleries in sapwood.

**Platypodidæ.**

*Diapus capillatus* Sampson; India; bores in *Quercus lamellosa*.
*Diapus impressus* Janson; India; bores in *Quercus incana*.
*Crossotarsus fairmairei* Chapuis; India, bores in *Quercus incana*.
*Platypus cylindrus* Fabricius; Europe; bores in staves.

**Scolytoplatypidæ.**

*Scolytoplatypus darjeelingi* Stebbing; India; tunnels timber of *Quercus lamellosa*.

## LEPIDOPTERA.

**Cossidæ.**

*Cossus cossus* Linnæus, goat moth, Europe; bores in wood. (See Willow.)
*Zeuzera pyrina* Linnæus; Europe; bores in wood. (See Horse-chestnut.)

**Geometridæ.**

*Anisopteryx æscularia* Schiffermiller; Europe; feeds on foliage.
*Cheimatobia brumata* Linnæus; Europe; defoliator.
*Hibernia aurantaria* Esp.; *H. defoliaria* Linnæus, and *H. marginaria* Borckh.; Germany; defoliators.
*Larentia dilutata* Borckh.; Europe; defoliator.
*Biston pomonarius* Hübner; Europe. (See Fruit.)

**Tineidae.**

*Tischeria complanella* Hübner and *T. simploniella* F. R.; Germany; leaf miners.

**Lasiocampidæ.**

*Eriogaster lanestris* Linnæus, *Lasiocampa quercus* Linnæus, and *Malacosoma neustria* Linnæus; Europe; defoliators.

**Lymantriidæ.**

*Dasychira pudibunda* Linnæus, * *Euproctis chrysorrhœa* Linnæus, * *Lymantria monacha* Linnæus, *Ocneria detrita* Esp., * *Porthetria dispar* Linnæus, *Porthesia similis* Fuessly; Europe; defoliators. (See Forest defoliators.)
*Gazalina apsara;* India; defoliates *Quercus lamellosa*.

**Sesiidæ.**

*Sesia conopiformis* Esp. and *S. vespiformis* Linnæus; Europe; bore in trunk.

**Tortricidæ.**

*Laspeyresia splendana* Hübner (*Carpocapsa*); Europe; breeds in acorns. (See Chestnut.)
*Laspeyresia grossana* Haworth (*Carpocapsa*). (See Beech.)
*Notocelia roborana* Treitschke; Europe. (See Gooseberry.)

## HYMENOPTERA.

**Cephididæ.**

*Janus cynosbati* Linnæus, a wood wasp mining in shoots; Europe.

**Tenthredinidæ.**

*Macrophya punctum-album* Linnæus; Russia; sawfly on foliage.

## LITERATURE.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
Nüsslin, O. Leitfaden der Forstinsektenkunde, 2d ed., 1913.
Hess, R. Der Forstschutz, 1898, 1900.

BARGAGLI, P. Rassegna Biologica Rincofori Europei, 1883-1887.
LINDINGER, L. Die Schildläuse (Coccidæ), 1912.
STEBBING, E. P. Indian Forest Insects. Coleoptera, 1914.
STEBBING, E. P. A Manual of Forest Zoology for India, 1908.

## OATS.

(*Avena sativa* Linnæus. Family Gramineæ.)

This crop is grown in all temperate regions and also in Australia, Africa, and South America, the greater part of the world's crop being raised in Europe. While the United States exports more oats than it imports, the latter trade is of considerable importance and there is always danger of importing pests with the grain. A full discussion of its insect pests will be found under the heading Grains and Grasses.

## OKRA.

(*Hibiscus esculentus*. Family Malvaceæ.)

A cultivated plant introduced into the United States from Africa; cultivated for its fruit pods.

### IMPORTANT OKRA INSECTS.

LEPIDOPTERA.

**Pyralidæ.**
*Sylepta derogata* Fabricius; Africa, Asia.

**Noctuidæ.**
*Cosmophila sabulifera* Guénée; Africa, Asia, Hawaii.

COLEOPTERA.

**Chrysomelidæ.**
*Diabrotica graminea* Ballou; Porto Rico.

## OLIVE.

(*Olea* spp. Family Oleaceæ.)

Fruit bearing trees or shrubs of the tropical and warm temperate parts of the old world to New Zealand. *Olea europæa* produces the olive prized as a fruit and for its oil. It is cultivated in California and New Mexico.

### A. BETTER KNOWN OLIVE INSECTS LIKELY TO BE IMPORTED.

**Aleurolobus olivinus** Silvestri.

(Olive White Fly. Aleyrodidæ; Hemiptera.)

*Host:* Olive.

*Injury:* Feeds on foliage, ordinarily not serious.

*Description and biology: Adult,* male body cream-colored or whitish ocher; body and wings sprinkled with a white waxy powder, forewings exhibit fulvous spots. *Pupa case,* length somewhat exceeding width; dorsum black, margin marked with a fringe of wax. *Egg* reticulated subelliptical, attached by a short pedicel; pale straw in color when first deposited, subsequently turning to brown. One generation a year.

*Distribution:* Italy.

SILVESTRI, F. Dispense di Entomologia Agraria, 1911, p. 128.

**Prays oleellus Fabricius.**

(Olive Moth. Hyponomeutidæ; Lepidoptera.)

*Host:* Olives.

*Injury:* Serious.

*Description and biology: Adult,* moth 6-6.5 mm. long, gray with silvery reflection, a black spot on the apex of the scutellum; front wings gray with silvery reflection, and with several black or dark spots; hind wings uniformly gray. *Pupa* obconical 5 mm. long in elongate silken cocoon. *Larva* when full grown, dusky color with two olivaceous stripes on the dorsum. In the first generation feeds on the leaves; in the next among the buds and blooms; and in the last in the fruit.

*Distribution:* France, Italy, Spain.

SILVESTRI, F. Bull. Lab. Zool. R. Sc. Agr. Portici, 1907, vol. 2, pp, 83–184, figs.1-68.

### **Dacus oleæ** Rossi.

(The Olive Fly. Trypetidæ; Diptera.)

*Host:* Olive (*Olea europaea, O. verrucosa, O. chrysophylla.*)

*Injury:* Serious pest of olive in Mediterranean regions.

*Description and biology: Adult,* female small, about 5 mm. in length; head dull yellow, eyes black, thorax black with silvery pubescence on dorsal surface forming three parallel black lines; abdomen black, covered with a scattered gray pubescence. The egg, larval, and usually the pupal stages are passed in the fruit. Occasionally pupation takes place in the soil. Larvæ hatch in from 2 to 4 days after deposition of the eggs; larval stage lasts approximately 10 to 13 days; pupal stage 13 to 49 days, depending upon the season.

*Distribution:* Sicily, Italy, north, east, and south Africa, Canary Islands, Mediterranean region, northern and western Asia, Himalayas, India.

SILVESTRI, F. Bull. Lab. Zool. R. Sc. Agr., Portici, 1913, vol. 8, p. 70.

## B. IMPORTANT OLIVE INSECTS.

### HEMIPTERA.

**Coccidæ.**

Armored—

*Aspidiotus (Chrysomphalus) nigropunctatus* Cockerell; Chili, Mexico; adult female scale 3 mm. in diameter, dirty gray; exuviæ pitch black with narrow reddish margin.

*Aspidiotus (Chrysomphalus) personatus* Cockerell; Jamaica; adult female scale very small, convex, circular, dark gray or black.

**Aspidiotus (Pseudaonidia) articulatus* Morgan; Jamaica. (See Coffee.)

*Aspidiotus (Pseudaonidia) duplex* Cockerell; Italy; on *Olea fragrans;* adult female scale 2.66 mm. in diameter, subcircular, moderately convex, dark, blackish brown, exuvia to one side and of orange color.

*Aspidiotus (Aonidia) oleæ* Leonardi; Africa.

*Lepidosaphes olivina* Leonardi; Africa.

*Chionaspis (Phenacaspis) bupleuri* Marchal; Tunis.

*Chionaspis nerii* Newstead; Algeria.

*Diaspis oleæ* Colvée; Spain.

**Fiorinia theæ* Green; India; adult female scale elongate, narrow, dark brown with distinct dark median marking. Male scale snow white indistinclty tricarinate (see pl. V, fig. 1).

*Leucaspis riccæ* Targioni-Tozzetti; France, Greece, Algeria, Italy; adult female scale 2.25 mm. long, 0.5 mm. broad, narrow, white, with sides parallel.

*Parlatoria affinis* Newstead; Algeria; adult female scale 1–1.25 mm. in diameter, when isolated circular, dusky white or pale ocherous.

*Parlatoria calianthina* Berlese and Leonardi; Italy and Algeria; adult female scale 2.3 mm. long, 2.6 mm. broad, white, dorsal exuvia subcentral.

Unarmored—

*Ceroplastes rusci* Linnæus; Italy; adult female covered with wax, antennæ 6-jointed.

*Euphilippia olivina* Berlese and Silvestri; Italy.

*Filippia oleæ* Costa; Italy, Algeria; adult female forms a white sac in the foliage.

*Lichtensia eitoni* Newstead; Algeria; adult female inclosed in a felted sac; adult male scale glossy white with strong central keel.

*Pollinia pollini* Costa; Italy; adult female scale pale yellow to brown, smooth head, convex, with median curled flossy like filaments on the dorsum.

### THYSANOPTERA.

**Phlœothripidæ.**

*Phlœothrips oleæ* Costa; Algiers, Italy, South America; attacks leaves, bloom and fruit and is an important pest in Italy according to Trabut.

### COLEOPTERA.

**Cerambycidæ.**

*Vesperus mauretanicus* Dry.; Algeria, Spain. (See Grape.)

**Curculionidæ.**

*Cionus fraxini* De Geer; Europe; breeds on leaves.

**Ipidæ.**

*Phlœotribus oleæ* Fabricius; barkbeetle; Southern Europe; Tunis; in nursery stock.

*Hylesinus fraxini* Fabricius and *H. oleæ* Fabricius; Europe; breed in bark and wood.

*Hylesinus vestitus* M. and R.; barkbeetle; Tunis, Corsica, Italy, Southern France; in *Pistacia* and olive.

### LEPIDOPTERA.

**Œcophoridæ.**

*Œcophora oliviella* Fabricius; Europe; infests fruit.

### LITERATURE.

Trabut, L. La Defense Contre les Cochenilles, 1910, p. 88.
Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.

## ONION; SHALLOT; LEEK; GARLIC.

(*Allium* spp. Liliaceæ.)

Bulbous root plants native of Asia domesticated for centuries and developed into many valuable varieties.

### A. BETTER KNOWN ONION INSECTS LIKELY TO BE IMPORTED.

#### Chortophila cilicrura Rondani.

(Shallot Fly. Anthomyidæ; Diptera.)

*Hosts:* *Allium* spp. (including shallot), asparagus, human excrement.

*Injury:* Breeds in the plant stems.

*Description and biology:* *Male fly* gray, with three brown stripes on scutellum, abdomen with deep black median stripe and brown segments; appendages black. *Female* lighter; length 4.5 mm. *Maggot* dirty white, with 14 teeth on apical margin of stigmal plate.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 427.

#### * Hylemyia antiqua Meigen.

(Onion Maggot. Anthomyidæ; Diptera.)

*Host:* Onions.

*Injury:* Serious injury to the roots.

*Description and biology:* *Fly* black, thickly dusted with gray, with dark flecks and stripes; legs piceous black; length 6.5 mm. *Maggot* yellowish, 5–6 mm. long.

*Distribution:* Europe. Introduced into United States.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 430, fig. 262.

Smith, J. B. New Jersey Exp. Sta. 1907, Bul. 200, pp. 10–15, figs. 1, 8, 11.

#### * Eumerus strigatus Fabricius.

(Onion Fly. Syrphidæ; Diptera.)

*Host:* Onions, *Iris*.

*Injury:* Breeds in the stems and bulbs.

*Description and biology:* *Fly* green; abdomen with gray hairy lunules at apex and at sides of the first three segments; antennæ dark; length 6–7.5 mm. *Maggot* grayish yellow. *Pupa* sometimes in soil, sometimes in flower shaft.

*Distribution:* Europe. Reported present in this country, by Felt, from Iris roots at Saratoga Springs, N. Y.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 434.

### B. IMPORTANT ONION INSECTS.

COLEOPTERA.

**Curculionidæ.**

*Hypera nigrirostris* Fabricius, *H. ononidis* Chevrolat; Europe. (See Clover.)

**Brachyceridæ.**

*Brachycerus albidentatus* Gyllenhal; Europe; breeds in roots of *Allium sativum* and *A. ascalonicum*.
*Brachycerus corrosus* Gyllenhal; Europe; breeds in roots of *Allium roseum*.
*Brachycerus pradieri* Fairmaire; Europe; breeds in roots of *Allium sphærocephalum*.
*Brachycerus undatus* Fabricius, breeds in roots of *Allium roseum*.

## ORACHE.

(*Atriplex hortensis*. Family Chenopodiaceæ.)

Plants cultivated for their succulent vegetation.

### IMPORTANT ORACHE INSECTS.

COLEOPTERA.

**Chrysomelidæ.**

*Cassida nebulosa* Linnæus. (See Beet.)

DIPTERA.

**Anthomyidæ.**

⁎ *Chortophila* (*Pegomya*) *hyoscyami* Panzer. (See Beet.)

## ORCHIDS.

(Family Orchidaceæ.)

Many species of orchids are imported by florists from all parts of the tropical and semitropical regions. Several important pests have been taken in quarantine.

### IMPORTANT ORCHID INSECTS.

ACARINA.

**Tyroglyphidæ.**

*Rhizoglyphus* (*Coepophagus*) *echinopus* F. & R. (See Potato.)

HEMIPTERA.

**Coccidæ.**

Armored—
*Aspidiotus* (*Chrysomphalus*) *alienus* Newstead; London, England.
⁎*Aspidiotus* (*Chrysomphalus*) *perseæ* Comstock; Central America.
*Aspidiotus* (*Chrysomphalus*) *portoricensis* Lindinger; Venezuela.
*Aspidiotus* (*Diaspidiotus*) *coloratus* Cockerell; Guatemala.
⁎*Aspidiotus* (*Pseudaonidia*) *articulatus* Morgan; Mexico.
⁎*Aspidiotus* (*Targionia*) *biformis* Cockerell; Trinidad, Venezuela, Grenada, Central America, Jamaica, Antigua, Colombia.
⁎*Aspidiotus* (*Targionia*) *biformis* var. *cattleyæ* Cockerell; Jamaica.
*Diaspis cattleyæ* Cockerell; Mexico, England.
*Fiorinia stricta* Maskell; New Zealand.
*Furcaspis oceanica* Lindinger; Venezuela.
*Lepidosaphes cocculi* Green; Philippine Islands.
*Lepidosaphes pallida* Green; Java.
*Parlatoria mytilaspiformis* Green; Hawaii.
⁎*Parlatoria proteus* Curtis; India, Brazil, Japan, Philippine Islands, Burma, United States.
⁎*Parlatoria pseudaspidiotus* Lindinger; India, Philippine Islands, Singapore. Has been introduced into the United States on mangos.
*Pinnaspis longula* Leonardi; Straits Settlements.

Unarmored—
*Asterolecanium aureum* Boisduval; Ceylon, West Indies.
*Asterolecanium epidendri* Bouché; Central America, South America, Samoa.
*Coccus acuminatus* Signoret; Hawaii.
*Coccus minimus* Newstead; Straits Settlements.
*Pseudococcus glaucus* Maskell; New Zealand.
⁎*Pulvinaria floccifera* Westwood; Venezuela, British Isles, Massachusetts, Indiana, California.

LEPIDOPTERA.

**Castniidæ.**

*Castnia licus* Drury; South America. (See Sugar cane.)

COLEOPTERA.

**Curculionidæ.**

* *Cholus forbesi* Pascoe, and * *Cholus cattleyæ* Champion have been introduced on orchids.

## PALMS.

The palms yield some very important articles of commerce, such as coconuts and dates, and are also considered very valuable as ornamental plants.

For convenience the pests of the coconut palm (*Cocos nucifera*), the date palm (*Phœnix dactylifera*), the royal palm (*Oreodoxa regia*), the sago palm (*Cycas revoluta*), and the toddy palm (*Phœnix sylvestris*) are treated under this heading.

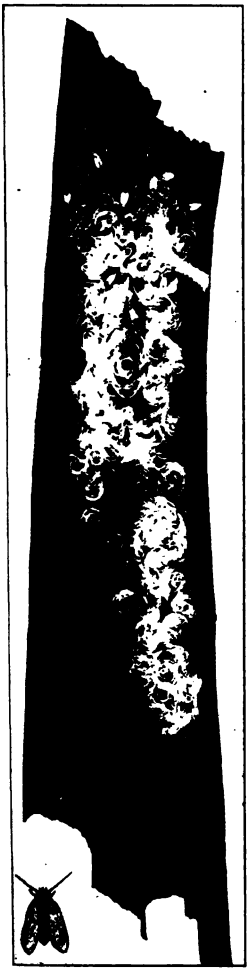


FIG. 77.—Coconut white fly (*Aleurodicus destructor*): Adult white fly, enlarged, at bottom. (Mackie.)

### A. BETTER KNOWN PALM INSECTS LIKELY TO BE IMPORTED.

**Aleurodicus destructor** Mackie.

(Coconut White Fly. Aleyrodidæ; Hemiptera.)

*Host:* Coconut palms.

*Injury:* Has the appearance of being a serious coconut enemy.

*Biology:* Eggs are laid on undersurface of the leaflets, where the young larvæ locate. Life history much the same as *Dialeurodes citri* R. and H. (See Citrus.) (See text fig. 77.)

*Distribution:* Philippines.

MACKIE, D. B.: Philippine Agricultural Review, vol. 5, No. 3, 1912.

**Levuana iridescens** Bethune-Baker.

(The Coconut Leaf Moth. Zygænidæ; Lepidoptera.)

*Hosts:* Coconut palm and royal palm (*Oreodoxa regia*).

*Injury:* Larvæ injurious to foliage, giving the trees a sickly appearance.

*Description and biology: Adult* female, head and thorax steel-blue; abdomen and legs ocherous, primary veins deep unicolorous steel-blue, secondaries iridescent steel-blue; wing expanse about 16 mm. *Eggs* deposited on under surface of leaflets, usually near the base. Upon hatching, which requires about 4 or 5 days, the larvæ begin feeding around the egg shell, gradually proceeding in a longitudinal line up the leaf, nibbling on the epidermal cells on the under surface of the leaflet; are full grown in 3 or 4 weeks, when they return to the base of the leaves and construct a white cocoon within which to pupate; the adults appear in about 7 days.

*Distribution:* Fiji.

JEPSON, FRANK P. Dept. Agric. Fiji, Council Paper No. 25, 1911, p. 35.

### **Oryctes rhinoceros** Linnæus.

(Rhinoceros Beetle. Scarabæidæ; Coleoptera.)

*Hosts:* Palm, aloes, sugar cane (occasionally).

*Injury:* Destructive to coconut palm in Malacca, Singapore, and Madras. May be introduced in plants.

*Description and biology: Adult beetle* large thickset, about 5 cm. long; and 25 mm. broad; color dark brown to black. The adults feed upon the soft tissues and unopened leaves of palms. *Larvæ* are found in decomposed vegetable matter and soil rich in humus about plant roots. *Pupa* is inclosed in hard case. The *eggs* are white but become dull with age; measure 3.5 mm. by 2 mm.; oval.

*Distribution:* Ceylon, India, Siam, Annam, Pahang, Sumatra, Java, Celebes. Ceram, Amboina, Philippine Islands, Formosa, Korea, China, Straits Settlements, Tahiti, Madras, Malabar.

Maxwell-Lefroy, H. Indian Insect Pests, 1906, p. 207.

Maxwell-Lefroy, H. Indian Insect Life, 1909, p. 255.

Ghosh, C. C. Memoirs Dept. Agric. India, Entom. Ser., 1911, vol. 2, No. 10, p. 193.

### **Promecotheca cumingii** Baly.

(The Coconut Leaf Miner Beetle. Hispidæ; Coleoptera.)

*Host:* Coconut (*Cocos nucifera*).

*Injury:* Mines the leaves in larval stage; adults also feed on leaves. May be introduced in leaves of nursery stock.

*Description and biology: Adult beetle* 7.5–10 mm. long and 1.6–2 mm. wide, general color, brown ocher; head small, elytral striæ finely punctate. *Eggs* deposited singly on underside of leaflets in a small hole made by the adult; entire larval and pupal periods spent in the leaf between the lower and upper epidermis. More injury is occasioned by the larva than by the adult. Tissues which have been attacked soon become brown and die. Egg stage about 32 days, and pupal stage about 7.5 days.

*Distribution:* Philippine Islands.

Jones, Chas. R. The Philippine Agric. Review, 1913, vol. 6, No. 5, p. 228.

### **Promecotheca reichei.**

(Coconut Leaf Miner. Hispidæ; Coleoptera.)

*Host:* Coconut palm.

*Injury:* Damage occasioned by the pest is usually local, but affected trees appear brown and unhealthy when viewed from a distance.

*Description and biology: Adult beetle* length 8 mm., breadth 2 mm.; general color golden; head quadrangular in shape and provided with powerful mandibles; thorax golden, basal third of elytra golden and remainder metallic blue. *Eggs* are deposited singly on under surface of leaflets; larvæ on hatching make their way into the leaf and tunnel between the upper and lower surfaces, feeding on the fleshy cells; pupate usually at extreme end of tunnel passage; pupal stage lasts from 18 to 20 days.

*Distribution:* Fiji.

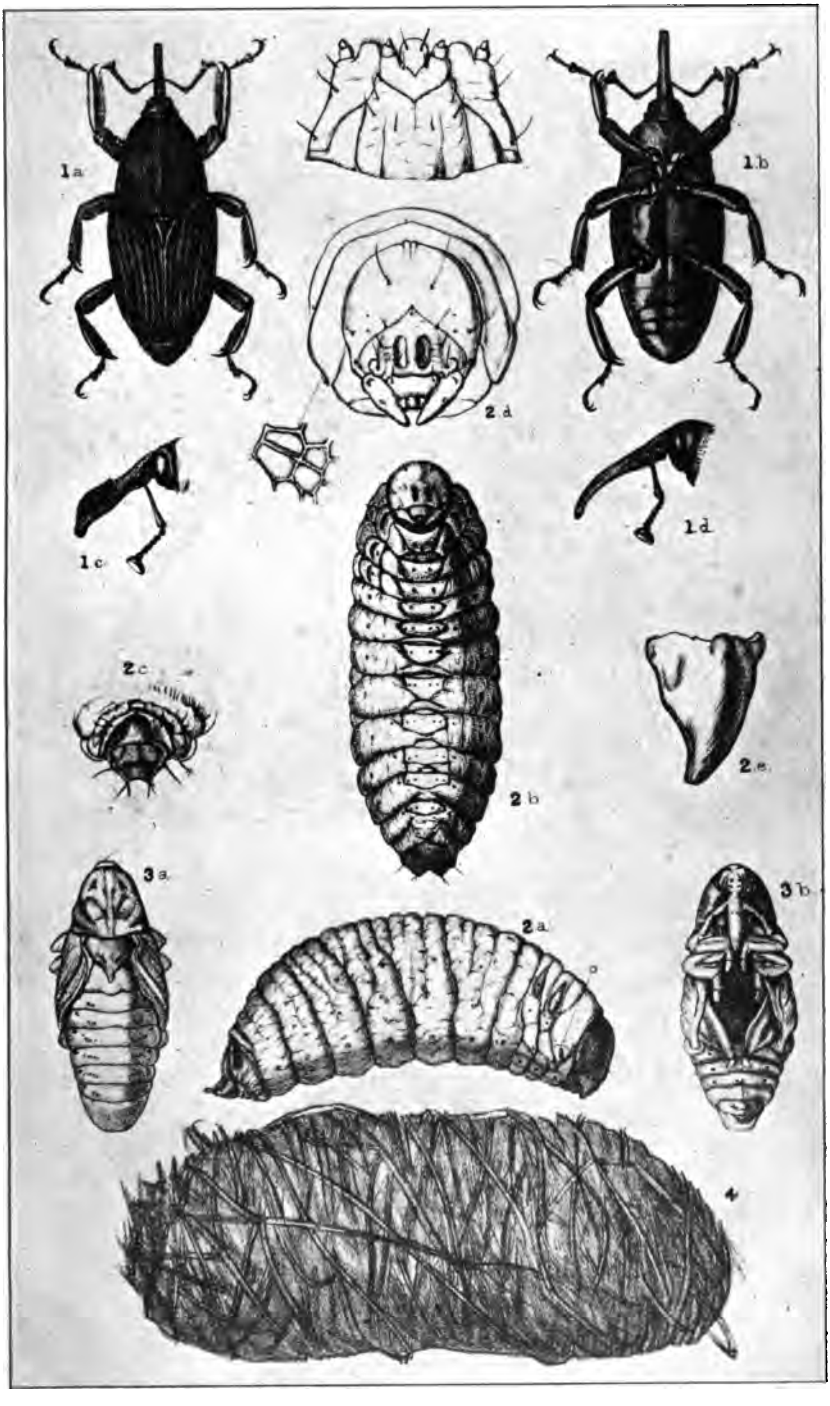
Jepson, Frank B. Dept. Agric. Fiji, Council Paper No. 25, 1911, p. 39.

### **Brontispa froggatti** Sharp.

(The Leaf Hispa. Hispidæ; Coleoptera.)

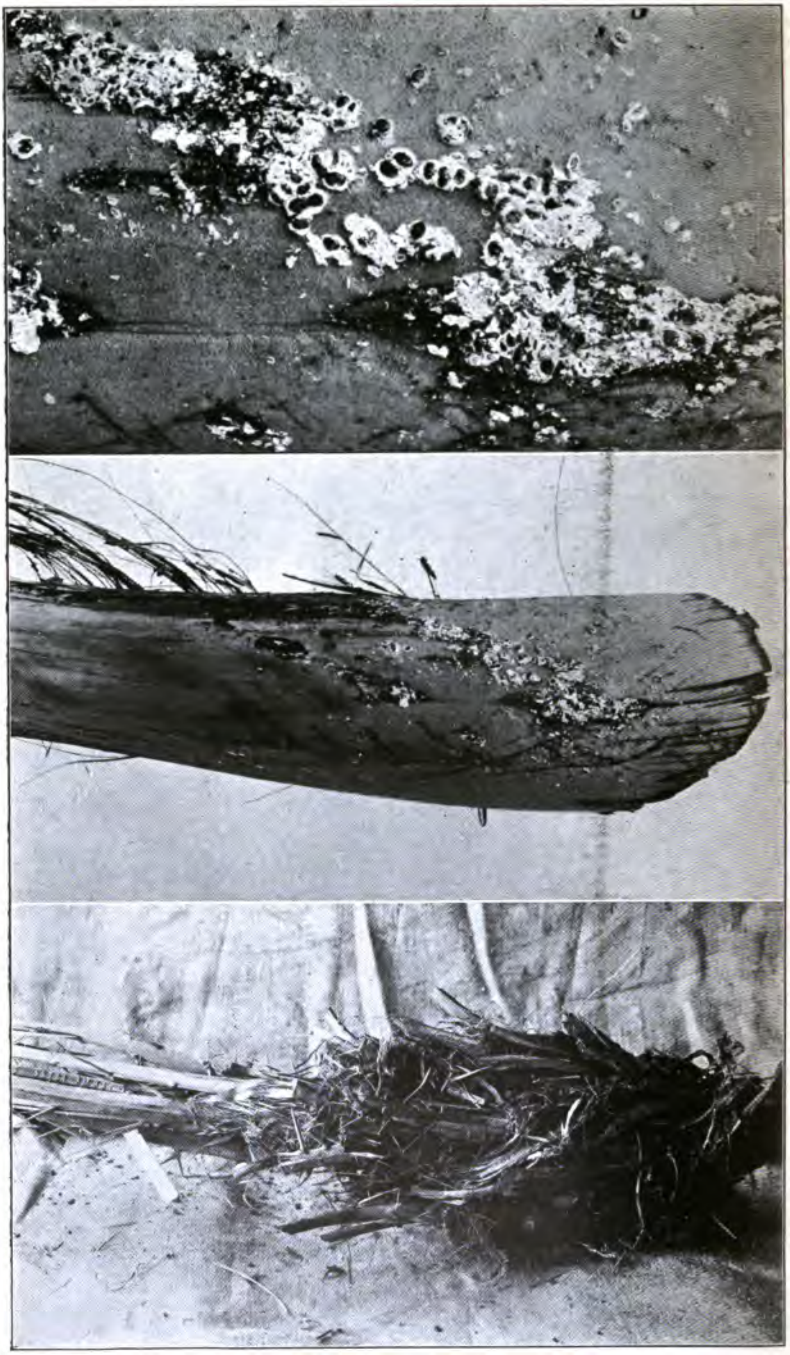
*Host:* Coconut palm.

*Injury:* Very injurious to young coconut groves in Solomon Islands. Liable to be imported on growing plants.



A PALM WEEVIL.

The palm weevil (*Rhynchophorus palmarum*): 1 *a–d*, Adult; 2 *a–e*, larva; 3 *a*, *b*, pupa; 4, cocoon. (Blandford.)



THE PALM SCALE.

*The palm scale (*Phœnicococcus marlatti*). (Original, Sasscer.)

*Description and biology: Adult beetle* about 12 mm. long from tip of antennæ to tip of abdomen, shining black, head small, antennæ 11-jointed, thorax almost square, slightly hollowed on sides. *Eggs* deposited in the folds of the opening fronds. *Larvæ* feed on surface of leaf and the adult also injures the foliage.

*Distribution:* New Britain and Solomon Islands.

FROGGATT, W. W. Dept. Agric. New South Wales, Science Bul. 2, 1912, p. 24.

### **Rhynchophorus ferrugineus** Fabricius (**signaticollis** Chevrolat).

(Red Palm Weevil. Calendridæ; Coleoptera.)

*Hosts:* Coconut palm (*Cocos nucifera*), toddy palm (*Phoenix sylvestris*), and date palm (*Phoenix dactylifera*).

*Injury:* Destructive to palms in India, Straits Settlements, and Ceylon. Liable to be introduced in plants.

*Description and biology: Adult weevil,* brown with conspicuous curved beak; about 37 mm. long. *Eggs* laid singly in tissues of palm tree. *Larvæ* on hatching tunnel in the soft tissues, gradually working into the stem; pupate in a cocoon of twisted fibers within the plant. (See text fig. 78.)

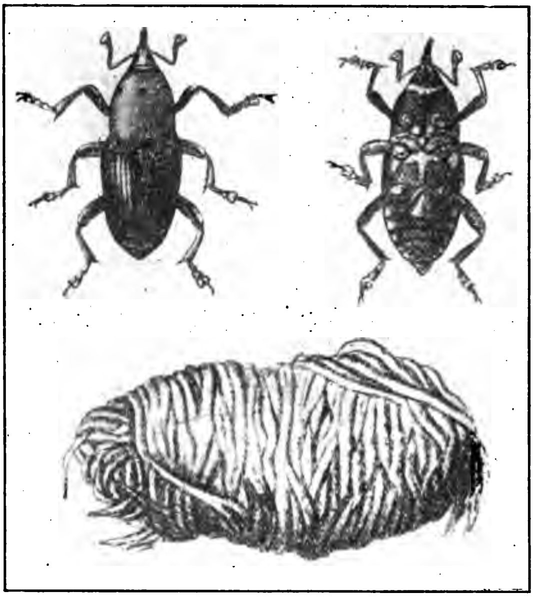


FIG. 78.—Red palm weevil (*Rhynchophorus ferrugineus*): Adults, cocoon. (Maxwell-Lefroy.)

*Distribution:* India, Ceylon, Straits Settlements, Andaman Islands, Persian Gulf, Philippine Islands.

MAXWELL-LEFROY, H. Indian Insect Pests, 1906, p. 208.

STEBBING, E. P. Indian Forest Pests, Coleoptera, 1914, pp. 444, 445; figs. 292, 293.

FROGGATT, W. W. Dept. Agric., New South Wales, Science Bul., 2, p. 19, August, 1912.

BANKS, CHARLES S. The Principal Insects Attacking the Coconut Palm, 1906, Pts. I and II, p. 154.

GHOSH, C. C. Mem. Dept. Agric. India, Entom. Ser., 1911, vol. 2, No. 10, p. 205.

### **Rhynchophorus palmarum** Linnæus.

(The Palm Weevil. Calendridæ; Coleoptera.)

*Hosts:* Palm and sugar cane.

*Injury:* Reported to be very serious in British Honduras.

*Description and biology:* A very large reddish weevil. Eggs are deposited in tissues of food plant; larva spends entire existence as a borer, and when full grown pupates in a rough cocoon constructed of fibers without leaving the plant. (See plate XXXI.)

*Distribution:* British Honduras, Trinidad, Lesser Antilles, Brazil, Cayenne, Surinam, and possibly generally distributed over tropical coast of South America and Central America.

**Chittenden, F. H.**, U. S. Dept. Agr., Bur. Entom., Bul. 38, 1902, pp. 23-25.
**Urich, F. W.** Bull. Dept. Agric. Trinidad and Tobago, 1912, vol. 11, p. 70.
**Ballou, H. A.** Insect Pests of the Lesser Antilles, 1912, p. 107.
**Blandford, Walter F. H.** Kew Bulletin, February-March, 1893, pp. 27-60.

## B. OTHER IMPORTANT PALM INSECTS.

### HEMIPTERA.

**Coccidæ.**

Armored—
_Aspidiotus pangoensis_ D. & F.; Samoa; coconut husks.
_Aspidiotus (Pseudaonidia) articulatus_ Morgan; Brazil, West Africa, Venezuela, Mexico; coconut. (See Coffee.)
_Aspidiotus (Pseudaonidia) trilobitiformis_ Green; West Africa, German East Africa, Japan, Venezuela, Brazil; coconut, sago palm. (See text fig. 32.)
_Aspidiotus (Pseudischnaspis) linearis_ Hempel; Brazil.
_Aspidiotus (Hemiberlesia) palmæ_ Morgan and Cockerell; East and West Africa, West Indies, Azores, Brazil; coconut.
_Aspidiotus (Hemiberlesia) simillimus_ Cockerell; Australia.
*_Aspidiotus (Chrysomphalus) perseæ_ Comstock; Florida, Mexico, Brazil; coconut. (See Avocado.)
_Aspidiotus (Chrysomphalus) personatus_ Comstock; British Guiana, Porto Rico, Mexico; coconut. (See Olive.)
_Aspidiotus (Chrysomphalus) propsimus_ Banks; Philippines.
_Aspidiotus (Chrysomphalus) scutiformis_ Cockerell; Central America.
_Aspidiotus (Chrysomphalus) ansei_ Green; Seychelles; _Cocos nucifera._
_Aspidiotus fissidens_ var. _pluridentatus_ Lindinger; German East Africa.
_Aspidiotus (Diaspidiotus) orientalis_ Newstead; German East Africa.
_Aspidiotus spinosus_ Comstock; Italy, German East Africa, Brazil.
_Aspidiotus varians_ Lindinger; German East Africa, Madagascar.
_Chionaspis inday_ Banks; Philippines.
_Chionaspis substriata_ Newstead; Uganda, British East Africa.
_Chionaspis samoana_ D. & F.; Samoa.
_Cryptaspidus nucum_ Lindinger; Madagascar.
*_Diaspis zamiæ_ Morgan; Germany, Colorado, Wisconsin (in greenhouses), Italy.
_Furcaspis oceanica_ Lindinger; Caroline Islands.
_Lepidosaphes mcgregori_ Banks; Philippines.
_Lepidosaphes unicolor_ Banks; Philippines.
_Lepidosaphes duponti_ Green; Seychelles; _Cocos nucifera._
_Leucodiaspis cockerelli_ de Charmoy; German East Africa, Brazil, Venezuela.
_Parlatoria blanchardii_ Targioni-Tozzetti; Australia, Algeria, Sahara, Egypt, Arabia; date palm. (See pl. 5, fig. 3.)
_Parlatoria greeni_ Banks; Philippines.
*_Parlatoria proteus_ Curtis; Brazil, Jamaica, Australia.
_Parlatoria mytilaspiformis_ Green.
_Chionaspis (Phenacaspis) cockerelli_ Cooley; China; sago palm.
_Chionaspis (Phenacaspis) dilatata_ Green; India. (See Mango.)
_Pinnaspis buxi_ Bouché; British Guiana, Trinidad, West Indies, Togoland, German East Africa; coconut. (See Betel nut.)
*_Poliaspis cycadis_ Comstock.

Unarmored—
_Asterolecanium ceriferum_ Green; Ceylon.
_Asterolecanium lineare_ Lindinger; Brazil.
_Asterolecanium palmæ_ Cockerell.
_Asterolecanium urichi_ Cockerell.
_Asterolecanium hilli_ Green; Australia; _Livistona humulis._
_Ceroplastes actiniformis_ Green; Ceylon.
_Ceroplastes myricæ_ Linnæus; South Africa, India, Europe (in greenhouses).
_Ceroplastes rubens_ Maskell; Australia, Hawaii, Japan.
_Coccus hesperidum_ Linnaeus; cosmopolitan; tea, citrus, palms (see pl. II, fig. 4).
_Coccus acutissimus_ Green; Ceylon; coconut, sago.
_Dactylopius coccus_ Costa; Canary Islands.
_Halimococcus lampas_ Cockerell.
_Icerya montserratensis_ Riley and Howard; West Indies, Grenada, Mexico. (See Citrus.)
_Icerya seychellarum_ Westwood. (See Citrus.)
_Lecanium pseudexpansum_ Green; Australia; _Pandanus odoratissimus._
_Paralecanium cocophyllæ_ Banks; Philippines.
*_Phœnicococcus marlatti_ Cockerell; Algeria, Egypt, Sahara; date palm. (See pl. XXXII.)

**Coccidæ**—Continued.
Unarmored—Continued.
- *Pseudococcus cocotis* Maskell; Guam.
- *Pseudococcus dubia* Newstead; Barbados, Grenada.
- *Pseudococcus pandani* Cockerell; Fiji; coconut.
- *Pseudococcus virgatus* Cockerell; Jamaica, Mexico; coconut.
- *Rhizœcus falcifer* Künckel; Algeria, Sicily.
- *Rhizœcus* (?) *terrestris* Newstead; London (greenhouse).
- *Ripersia palmarum* Ehrhorn; Hawaii; *Cocos nucifera, Areca lutescens.*

COLEOPTERA.

**Calendridæ.**
- *Rhabdocnemis obscurus* Boisduval; Hawaii, etc. (See Sugar Cane.)

LEPIDOPTERA.

**Pyralidæ.**
- **Ephestia cautella* Walker; Egypt; breeds in half ripe dates. (Gough, L. H.: The Agric. Journ. Egypt, vol. 3, 1914, pp. 104–105.)

**Lycænidæ.**
- *Virachola livia* Klug; Egypt; breeds in dates (Gough, l. c., p. 105).

**Tineidæ.**
- *Ereunetis flavistriata* Walsingham; Hawaii. (See Sugar Cane.)

**Zygænidæ.**
- *Levuana iridescens* Bethune-Baker: Fiji. (See Royal palm.)

## PANAMA RUBBER.

(*Castilloa elastica.* Family Moraceæ.)

African, Mexican, and Central American trees yielding rubber.

### A PANAMA-RUBBER INSECT LIKELY TO BE IMPORTED.

**Inesida leprosa** Fabricius.

(Castilloa Borer. Cerambycidæ; Coleoptera.)

*Host:* Panama rubber (*Castilloa elastica*).

*Injury:* Very serious borer. In West Africa it has almost ruined Castilloa culture.

*Description and biology: Beetle* brown, venter and greater part of elytra covered with yellowish brown scales; a black triangle on lateral margin of each elytron beyond middle; humeri of elytra strong and coarsely punctured; length 25–35 mm. *Larva* 5 cm. long, with large clypeus. *Eggs* laid at base of trunk. Pupates in larval tunnel.

*Distribution:* West and East Africa.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 502, 503.

## PAPAYA.

(*Carica papaya.* Family Passifloraceæ.)

A tropical fruit-bearing tree grown in Florida.

### IMPORTANT PAPAYA INSECTS.

HEMIPTERA.

**Coccidæ.**
- *Aspidiotus destructor* Signoret; Amani, Africa.
- *Pseudoparlatoria ostriata* Cockerell; Cuba.

COLEOPTERA.

**Calendridæ.**
- *Rhabdocnemis obscurus* Boisduval. (See Sugar cane.)

DIPTERA.

**Trypetidæ.**
- *Ceratitis capitata* Wiedemann; attacks *Carica papaya* and *C. quercifolia.* (See Fruit.)
- * *Toxotrypana curvicauda* Gerstaecker; papaya fruit fly; West Indies, Florida (F. Knab and W. W. Yothers, Journ. Agr. Res., vol. 2, pp. 447–453, 2 plates.

## PARA PLUM.

(*Spondias* spp. Family Anacardiaceæ.)

### AN IMPORTANT PARA-PLUM INSECT.

DIPTERA.

**Trypetidæ.**

*Anastrepha fraterculus* Wiedemann. (See Fruit.)

## PARA RUBBER.

(*Hevea brasiliensis* Muell. Family Euphorbiaceæ.)

This tree produces the Para rubber of commerce, or caoutchouc. It grows in Brazil and Guiana, and attempts have been made to grow it in Florida.

### IMPORTANT PARA-RUBBER INSECT.

ISOPTERA.

**Termitidæ.**

*Coptotermes gestroi* Wasmann, white ant; India; destroys the roots.

## PARSLEY.

(*Carum petroselinum*. Family Umbelliferæ.)

An herb cultivated for its foliage, much used as a garnish.

### AN IMPORTANT PARSLEY INSECT.

LEPIDOPTERA.

**Pyralidæ.**

* *Pionea ferrugalis* Hübner; Europe, Asia, North America. (See Cabbage.)

## PARSNIP.

(*Pastinaca sativa* Linnæus. Family Umbelliferæ.)

The parsnip is grown in Europe and America, and, being a root crop, is liable at any time to introduce root pests.

### IMPORTANT PARSNIP INSECTS.

ACARINA.

**Tyroglyphidæ.**

**Rhizoglyphus* (*Coepophagus*) *echinopus* F. and R. (See Potato.)

LEPIDOPTERA.

**Gelechiidæ.**

*Depressaria nervosa* Hw. and *D. depressella* Hübner; Europe; attack buds and flower heads.

DIPTERA.

**Agromyzidæ.**

*Phytomyza affinis* Fallen. (See Tobacco.)

**Trypetidæ.**

*Acidia heraclei* Linnæus; Europe. (See Celery.)

## PEA.

(*Pisum sativum*. Family Leguminosæ.)

The various varieties of peas are grown extensively in Europe and America. Some of the pests of the peas, such as the weevils, have been very widely distributed by commerce. (See Bean.)

## A. BETTER KNOWN PEA INSECTS LIKELY TO BE IMPORTED.

### * **Etiella zinckenella** Treitschke.

(Pea Pod Borer. Pyralidæ; Lepidoptera.)

*Hosts:* Peas, bean, Sann hemp (*Crotalaria*).

*Injury:* Breeds in the pods.

*Description and biology: Adult,* moth with wing expanse 18-30 mm., pale rufous; forewings gray brown, with white marginal fascia and a transverse rufous bar, hindwing with brown suffusions and lines. *Pupa* in spindleform cocoon. *Larva* bores in the pods of legumes.

*Distribution:* Europe, Africa, Asia, West Indies, California, Colorado, Texas, Florida, Oklahoma, nearly cosmopolitan.

MAXWELL-LEFROY, H. M. Mem. Dept. Agric. India, vol. 1, 1907, p. 204.

CHITTENDEN, F. H. U. S. Dept. Agr. Bur. Entom., bul. 82, pp. 25–28, 1909.

### **Laspeyresia (Grapholitha)** spp.

(Pea Moths. Tortricidæ; Lepidoptera.)

*Species: L. dorsana* Fabricius; Europe; peas, beans, *Orobus tuberosus,* and *Trifolium pratense. L. nebritana* Treitschke; Sudan; lentils, field peas, wild legumes. **L. nigricana* Stephens; Europe and Canada since 1893; peas.

*Injury:* Bore in the pods.

*Description and biology: Moths,* brownish; *dorsana* with crescentiform white spots on forewings; *nigricana* a little smaller than *nebritana,* the latter with two curved lines near tip on each forewing. Larvæ bore in pods.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 281, 282, 283, figs. 205–206.

### **Contarinia pisi** Winn.

(Pea Midge. Itonididæ [Cecidomyiidæ]; Diptera.)

*Hosts:* Pea.

*Injury:* Breeds in the hulls of peas, impairing or destroying the yield.

*Description: Midge,* yellow, thorax banded with brown, antennæ black; length 2 mm. *Maggot* white, 3 mm. long.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 446, 447.

## B. OTHER IMPORTANT PEA INSECTS.

### HEMIPTERA.

**Aphididæ.**

* *Macrosiphum pisi* Kaltenbach.

### COLEOPTERA.

**Elateridæ.**

*Agriotes lineatus* Linnæus. (See Tobacco.)

**Mylabridæ (Bruchidæ).**

* *Mylabris rufimanus* Boheman, California, * *M. pisorum* Linnæus, *M. lentis* Frölichs, *M. pallidicornis* Boheman, **Acanthoscelides obtectus* Say, **Pachymerus chinensis* Linnæus, * *P. quadrimaculatus* Fabricius; attack seed. (See Beans.)

**Curculionidæ.**

*Sitona lineata* Linnæus, **S. flavescens* Marsh, and **S. hispidula* Fabricius; Europe. (See Clover.)

### LEPIDOPTERA.

**Lycænidæ.**

*Zizera labradus* Godt.; Australia; attacks pods. (See Beans.)

### DIPTERA.

**Agromyzidæ.**

*Phytomyza affinis* Fallen. (See Tobacco.)

## PEACH; ALMOND.

(*Amygdalus* spp. Family Rosaceæ.)

Delicious fruit-bearing trees of temperate and warm climates. The almond pit is much sold as a nut.

### A. BETTER KNOWN PEACH INSECTS LIKELY TO BE IMPORTED.

#### **Uracanthus acutus** Blackburn.

(Cerambycidæ; Coleoptera.)

*Hosts:* Peach, apricot, plum.
*Description and biology: Adult,* length about 14 mm.; color obscure ferruginous; covered with short pubesence.
*Distribution:* Australia.

Blackburn, T. Proc. Linn. Soc. New South Wales, ser. 2, 1889, vol. 4, p. 451.

#### **Conogethes punctiferalis** Guérin.

(Northern Peach Moth. Pyralidæ; Lepidoptera.)

*Host:* Peach.
*Injury:* Infests the fruit.
*Description: Adult,* wing expanse 21–25 mm., bright yellow, thickly mottled with black spots. *Pupa* dark reddish brown. Pupates on side of peach stone. *Larva,* length 20 mm., cylindrical, with a few erect hairs; color dirty white, almost hidden by pinkish markings. Attacks ripening fruit, eating and webbing surface. *Eggs* deposited on half-grown peaches.
*Distribution:* Australia.

Froggatt, W. W. Australian Insects, 1907, p. 273.
Tryon, Henry. Ann. Rept. Dept. Agri. for years 1889–90, p. 75. Brisbane, Queensland, 1890.

### B. OTHER IMPORTANT PEACH INSECTS.

HEMIPTERA.

**Coccidæ.**
Armored—
_Aspidiotus (Pseudaonidia) clavigera_ Cockerell; Hawaii.
*_Aspidiotus (Diaspidiotus) ostreæformis_ Curtis; British Isles.
_Diaspis leperii_ Signoret; Europe.
_Diaspis squamosus_ Newstead and Theobald; Egypt.
*_Epidiaspis piricola_ Del Guercio; Europe.
_Parlatoria affinis_ Newstead; Algeria.
_Parlatoria calianthina_ Berlese and Leonardi; Algeria, Italy.
*_Pseudoparlatoria parlatorioides_ (Comstock); Brazil, Mexico.
Unarmored—
_Lecanium kunoensis_ Kuwana; China.
*_Lecanium persicæ_ (Fabricius); Europe.
_Lecanium rugosum_ Signoret; France, Germany.
_Lecanium vini_ Bouché; Europe.

**Lygæidæ.**
_Nysius vinitor_ Bergroth; Australia. (See Fruit.)

COLEOPTERA.

**Elateridæ.**
_Agriotes lineatus_ Linnæus. (See Tobacco.)

**Bostrychidæ.**
_Apate monachus_ Fabricius; Africa, West Indies, attacks almond. (See Citrus.)

**Chrysomelidæ.**
_Aulacophora olivierei_ Guérin, leaf beetle; Australia. (See Cucurbits.)

**Brachyrhinidæ.**

*Brachyrhinus ligustici* Linnæus; Europe. (See Grape.)
*Brachyrhinus corruptor* Host; Italy; attacks almond. (See Grape.)

**Scolytidæ.**

*Scolytus amygdali* Guérin; Mediterranean region; bark beetle in almond and apricot trees, very injurious.

## LEPIDOPTERA.

**Xyloryctidæ.**

*Cryptophaga unipunctata* Donovan; Australia. (See Plum, Cherry.)

**Pyralidæ.**

*Dichocrocis punctiferalis* Guénée; Queensland. (See Corn.)

## DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann, attacks peach and almond. (See Fruit.)
*Anastrepha ludens* Loew; Mexico. (See Fruit.)
*Dacus diversus* Coquillett; India. (See Fruit.)
*Dacus persicæ* Rig.; India. (See Fruit.)
*Bactrocera tryoni* Froggatt; Orient. (See Fruit.)

# PEAR.

(*Pyrus communis*, etc. Family Rosaceæ.)

Fruit trees native of south-central Europe and Asia and much cultivated in this country for their delicious fruits.

### A. BETTER KNOWN PEAR INSECTS LIKELY TO BE IMPORTED.

**Psylla pyrisuga** Förster.

(The Large Pear Psylla. Psyllidæ; Hemiptera.)

*Host:* Pear.

*Injury:* Quite injurious in middle Europe and Japan.

*Description and biology: Adult* marked with black and red, wings yellow. Female about 3.5 mm. and male 2.5 mm. in length. Winters in adult condition under bark scales of the trees. *Eggs* are laid singly or in small groups in hairs of leaf and flower stems or on leaves. *Nymph* is dark yellow in color, with waxy secretion. The foliage is distorted and leaves rolled up; also the young branches are killed and young fruit destroyed.

*Distribution:* Europe, Japan.

HENCHEL, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 490.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 647.

**Stephanitis pyri** Fabricius.

(The Pear Tingis. Tingitidæ; Hemiptera.)

*Hosts:* Pear, apple.

*Injury*: Serious pest to pear and apple in Europe.

*Description and biology: Adult*, about 3 mm. long; body flat and covered with relatively large wings of a beautiful lace network; lobes of same pattern extend from each side of prothorax; general color brownish, with dark bands across wings. *Nymph* oval in outline, pale greenish in color and abdominal segments each with a spine on each side; two transverse dusky bands on bodies of older individuals. *Eggs* ovate, oblong, greenish white in color, 0.6 mm. long. Adults winter around base of host plants, reproducing in spring on under surface of leaves, where all stages may be found at same time during summer. Badly infested leaves become yellow, then brown, and die. (See text fig. 79.)

*Distribution:* Europe.

Costa, Achille. Insetti nocivi all' Agricoltura, 1879, p. 166.
Silvestri, F. Dispense di Entomologie Agraria, 1911, p. 82.

### **Nephopteryx rubrizonella** Ragonot.

(Pear Fruit Borer. Pyralidæ; Lepidoptera.)

*Host:* Pear.

*Injury:* Destroys yearly 30 to 40 per cent of fruit.

*Description and biology: Adult,* wing expanse 25 mm. Forewing grayish brown to grayish black, crossed by two equidistant irregularly pinnated grayish-bordered black lines; outer margin and basal half much deeper in color; hindwing dark gray; thorax colored like forewing, abdomen paler. Two brooded; first occurs in July, second in September and October. *Pupa,* deep reddish brown. Pupates in core of fruit. *Larva,* length 20 mm.; spindle-shaped, color pinkish brown; attacks core of fruit. Stage lasts three weeks or more. *Eggs,* deposited on lower surface of twigs, about 20 in a mass, covered by a white silk web.

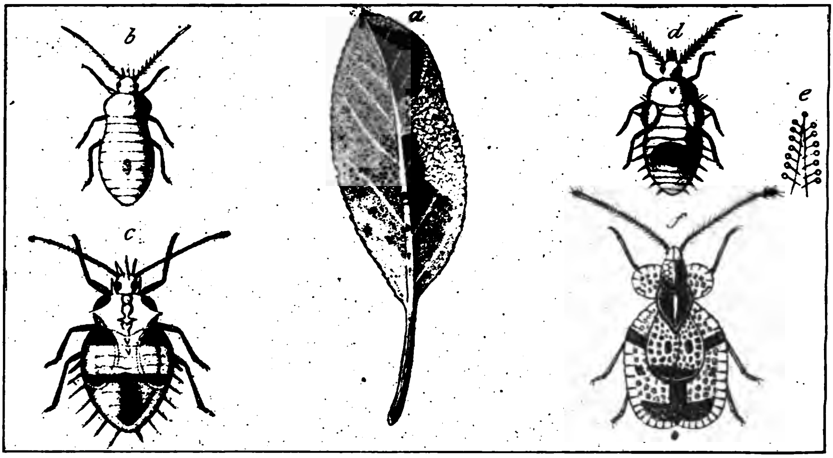


Fig. 79.—The pear tingis (*Stephanitis pyri*): *a,* Injured leaf; *b, d,* nymphal stages; *e,* much enlarged hair; *f,* adult. (Costa.)

*Distribution:* Japan.

Matsumura, M. U. S. Dept. Agric., Div. Ent., Bul. 10, 1898, p. 38.

### **Dasyneura pyri** Bouché.

(Pear Leaf-Curling Midge. Itonididæ [Cecidomyiidæ]; Diptera.)

*Host:* Pear.

*Injury:* Rolls edges of leaves.

*Description and biology: Adult,* length 2 mm. Brown, with limpid wings and tawny palpi. Occurs in spring. *Pupates* in the soil. Whitish maggots.

*Distribution:* Europe.

Theobald, F. V. Insect Pests of Fruit, 1909, p. 350.

### **Janus compressus** Fabricius.

(The Bud-stinger. Tenthredinidæ; Hymenoptera.)

*Host:* Pear.

*Injury:* Hollows out medullary canal in twigs.

*Description and biology: Adult* male, length 7 mm.; color black, with a transverse yellow band on thorax; abdomen entirely yellow; female 8 mm.; blackish, with three yellow spots on thorax and circle of red on abdomen. Occurs in May. One generation. *Pupates* in spring in gallery in shoot. *Larva,* length 6 mm.; white; makes gallery in twig. Winters in this stage in lower part of gallery. *Eggs* placed in buds.

*Distribution:* Europe.

GENAUX, G. Entomologie et Parasitologie Agricoles, 1904, p. 304.
MUTILLOT, L. Les Insectes Nuisibles, 1891, p. 189.

### **Pamphilius flaviventris** Retz.

(Social Pear Sawfly. Tenthredinidæ; Hymenoptera.)

*Hosts:* Pear, plum, cherry, white thorn, and other rosaceous plants.

*Injury:* Considerable damage. Strips foliage from trees.

*Description and biology: Adult,* female, black; antennæ and legs yellowish; abdomen tawny at apex, with yellow triangular mark on sides of segments; ventrally bands of yellow; male, abdomen reddish yellow from second segment to apex; lower part of head yellow; wing expanse 8–12 mm. *Pupates* in cocoon in soil. *Larva,* length 25 mm.; orange yellow; head black; two black spots on second segment; has no prolegs; spins tent over leaves on which it feeds; winters in cocoon; may suspend development and remain in soil over a second winter. *Eggs* are deposited on under surface of leaves in groups of 30 to 60. Incubation requires 6 or 7 days.

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 338.

## IMPORTANT PEAR INSECTS.

### HEMIPTERA.

**Coccidæ.**

Armored—
- _Aspidiotus_ (_Diaspidiotus_) _africanus_ Marlatt; Africa.
- *_Aspidiotus_ (_Aonidia_) _lauri_ Bouché; Germany.
- *_Aspidiotus_ (_Diaspidiotus_) _ostreæformis_ Curtis; Europe, Canada.
- _Aspidiotus pectinatus_ Lindinger; South Africa.
- _Aspidiotus_ (_Diaspidiotus_) _pyri_ Lichtenstein; France, Switzerland.
- *_Diaspis pentagona_ Targioni-Tozzetti; South Africa, Australia, Italy.
- _Diaspis pyri_ Colvée; Spain, Germany.
- _Diaspis santali_ Maskell; New Zealand.
- _Diaspis squamosus_ Newstead and Theobald; Great Britain.
- *_Epidiaspis piricola_ Del Guercio; Germany, Italy, France, Russia.
- _Parlatoria calianthina_ Berlese and Leonardi; Spain, Victoria, New South Wales.
- _Parlatoria pyri_ Marlatt; China.

Unarmored—
- _Ceroplastes rubens_ Maskell; Australia, Hawaii, Japan.
- *_Lecanium bituberculatum_ Targioni-Tozzetti; England, France, Sweden, Italy, Germany.
- _Lecanium capreæ_ Linnæus; Europe, Nova Scotia.
- _Lecanium coryli_ Linnæus; Europe, Algeria.
- _Lecanium glandi_ Kuwana; Japan.
- _Lecanium kunoensis_ Kuwana; China.
- _Lecanium rugosum_ Signoret; France, Germany.
- _Lecanium tiliæ_ Linnæus; Europe.
- _Lecanium vini_ Bouché; Europe.

### COLEOPTERA.

**Buprestidæ.**
- *_Agrilus sinuatus_ Olivier; Europe; introduced into United States; borer.

**Cerambycidæ.**
- _Cerambyx scopolii_ Fuessly; Europe; borer.
- _Liopus nebulosus_ Linnæus; Europe; borer.

**Curculionidæ.**

*Magdalis cerasi* Linnæus; Europe; bores in branches.
*Anthonomus pomorum* Linnæus; Europe; bud weevil. (See Apple.)
*Anthonomus pedicularius* Linnæus, *A. pyri* Boheman, and *A. spinotus* Redtenbacher; Europe; all weevils.
*Leptops hopei* Schonherr; Victoria. (See Apple.)

**Scolytidæ.**

*Scolytus pruni* Ratzeburg; Europe. (See Plum.)
*Taphrorychus bicolor* Herbst; Europe; galleries in trees.

LEPIDOPTERA.

**Lasiocampidæ.**

*Gastropacha quercifolia* Linnæus. (See Fruit.)

**Geometridæ.**

*Anisopteryx æscularia* Schiffermiller. (See Forests.)

**Cossidæ.**

*Cossus tristis* Dru.; Africa. (See Apple.)

**Tortricidæ.**

*Capua angustiorana* Haworth; Europe, Asia, Africa. (See Apricot.)

HYMENOPTERA.

**Tenthredinidæ.**

*Priophorus padi* Linnæus; Europe. (See Plum.)

DIPTERA.

**Trypetidæ.**

*Anastrepha fraterculus* Wiedemann. (See Fruit.)
*Ceratitis capitata* Wiedemann. (See Fruit.)

**Itonididæ.**

* *Contarinia pyrivora* Riley; Europe, North America; gall midge.

## PERSIMMON.

(*Diospyros* spp. Family Ebenaceæ.)

Fruit trees of the tropics, of which several species are cultivated in this country.

### IMPORTANT PERSIMMON INSECTS.

HEMIPTERA.

**Coccidæ.**

Armored—
*Aspidiotus* (*Aonidia*) *ebeni* Leonardi; Ceylon.
Unarmored—
*Ceroplastes rubens* Maskell; Japan; *Diospyros kaki.*
*Coccus bicruciatus* Green; Ceylon; *Diospyros ebenum.*
*Phenacoccus pergandei* Cockerell; Japan; *Diospyros kaki.*

DIPTERA.

**Trypetidæ.**

*Anastrepha fraterculus* Wiedemann, attacks *Diospyros kaki,* the Japanese persimmon. (See Fruit.)
*Ceratitis capitata* Wiedemann, attacks *Diospyros kaki.* (See Fruit.)

LEPIDOPTERA.

**Cosmopterygidæ.**

*Kakivoria flavofasciata* Nagano; Japan; injures fruit.

## PINE.

(*Pinus* spp. Family Pinaceæ.)

Evergreen resiniferous trees distributed throughout the northern hemisphere; in the tropical and subtropical regions they are confined to the mountains. They are very valuable timber trees and many of them yield turpentine, tar, pitch from the trunk, and medicinal oils from the leaves and young shoots. Edible seeds are produced by some. For convenience the insect pests are arranged under Conifers.

## PINEAPPLE.

(*Ananas sativus*. Family Bromeliaceæ.)

A plant indigenous to America but now cultivated in Hawaii and other parts of the world.

### IMPORTANT PINEAPPLE INSECTS.

HEMIPTERA.

**Coccidæ.**

Armored—

*Aspidiotus* (*Targionia*) *bromeliæ* Leonardi; England, Seychelles.

Unarmored—

*Pseudococcus ananassæ* Kuwana; Japan.
*Pseudococcus brevipes* Cockerell; Jamaica, Antigua, Dominica.
*Pseudococcus bromeliæ* Bouché; Hawaii.

LEPIDOPTERA.

**Tineidæ.**

*Ereunetis flavistriata* Walsingham; Hawaii. (See Sugar cane.)

DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann. (See Fruit.)
*Dacus xanthodes* Broun. (See Fruit.)

COLEOPTERA.

**Calandridæ.**

*Metamasius ritchiei* Marshall; Jamaica. (Bull. Ent. Res., vol. 7, p. 197.)

## PISTACHIO.

(*Pistacia vera*, etc. Family Anacardiaceæ.)

A nut-bearing tree of Asia and Europe, cultivated in California.

### IMPORTANT PISTACHIO INSECTS.

HEMIPTERA.

**Coccidæ.**

Armored—

*Diaspis gennadii* Leonardi; Greece, Italy.
*Leucaspis pistaciæ* Lindinger; Cyprus; *Pistacia lentiscus*.

Unarmored—

*Ceroplastes rusci* Linnæus; *Pistacia lentiscus*, *P. terebinthus*.

## PLANE TREE; BUTTONWOOD; SYCAMORE.

(*Platanus* spp. Family Platanaceæ.)

Ornamental deciduous trees of America, Europe, and Asia, valued for their dense shade.

### IMPORTANT SYCAMORE INSECTS.

COLEOPTERA.

**Anobiidæ.**

*Xestobium rufovillosum* DeGeer; England; bores in wood of old-standing trees.

**Scarabæidæ.**

*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus, Europe; larvæ injure roots of seedlings.

**Cerambycidæ.**

*Æolesthes sarta* Solsky; India; bores in trunks of *Platanus orientalis*.

**Ipidæ.**

*Anisandrus dispar* Fabricius; Germany; ambrosia beetle.

LITERATURE.

Lindinger, L. Die Schildläuse (Coccidæ), 1912.
Nüsslin, O. Leitfaden der Forstinsektenkunde, 2d ed., 1913.
Hess, R. Der Forstschutz, 1900, vol. 2.
Stebbing, E. P. Indian Forest Insects, Coleoptera, 1914.

## PLANTAIN.

(See Banana.)

## PLUM; CHERRY; PRUNE.

(*Prunus* spp. Family Rosaceæ.)

Deciduous trees of the northern hemisphere, with showy flowers and delicious fruits, of which many horticultural varieties are cultivated in this country.

### A. BETTER KNOWN PLUM INSECTS LIKELY TO BE IMPORTED.

*** Eriophyes spp.**

(Plum Blister Mites. Eriophyidæ; Acarina.)

*Species:* **E. phloeocoptes* Nalepa; Europe, North America; *Prunus domestica, P. insititia, P. spinosa. E. similis* Nalepa; Europe; *Prunus armeniaca, P. chamæcerasus, P. domestica, P. insititia, P. spinosa.* **E. padi* Nalepa; Europe, North America; *Prunus padus. P. domestica, P. spinosa.*

*Injury:* Form different kinds of blister galls on plum trees and are quite injurious. These four-legged blister mites are so small that they are easily transported on nursery stock, hence the wide distribution.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 125–127.

**Psylla pruni** Scopoli.

(The Plum Psylla. Psyllidæ; Hemiptera.)

*Hosts:* Plum, *Prunus spinosa*; *P. insititia.*

*Injury:* Not at present an important pest.

*Description and biology: Adult,* thorax marked with red and brown; abdomen with broad brown bands on sides and back; wings dark brown. Development and generations similar to *P. pyrisuga.* (See Pear.)

*Distribution:* Europe, Siberia.

HENCHEL, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 490.

**Peltophora pedicillata** Kirby.

(The Cherry Bug. Pentatomidæ; Hemiptera.)

*Hosts:* Cherry; strong-scented flowering shrubs; wild fig.

*Injury:* Probably not at present important.

*Description and biology: Adult,* about 12 mm. long; bright metallic green in color with black spots on dorsum. The greater part of ventral surface, edges of thorax, and two blotches at base of scutellum bright coral red.

*Distribution:* Australia (New South Wales to North Queensland).

FROGGATT, W. W. Australian Insects, 1907, p. 327.

**Diphucephala colaspidoides** Gyllenhal.

(The Cherry Green Beetle. Scarabæidæ; Coleoptera.)

*Hosts:* Cherry and other fruit trees; shrubs.

*Injury:* Very serious at times. Defoliation by adults.

*Description and biology: Adult,* length 8 mm.; metallic green; smooth; elytra deeply marked with punctured striæ. Damage done in this stage. *Larva* feeds on roots of various plants. Not of economic importance. (See plate XXXIII.)

*Distribution:* Southern Australia.

FRENCH, C. Handbook of Destructive Insects of Victoria, 1893, pt. 2, p. 27.

### **Rhynchites coeruleus** De Geer.

(Twig Cutter. Rhynchitidæ; Coleoptera.)

*Host:* Apple.

*Injury:* Cuts off apple shoots. Only nursery stock and bush trees attacked.

*Description and biology: Adult,* length 3–4 mm.; deep blue, shiny, clothed with long, upright fuscous pubescence; antennæ, legs, and rostrum black; elytra, with deep punctured striæ. Appear in spring and feed on leaves. *Pupate* in soil. *Larvæ* white, feed about a month, then enter soil. *Eggs* placed singly in soft shoots 2 to 4 inches from tips. Shoots cut off below place of oviposition. (See text fig. 80.)

*Distribution:* Europe.

Theobald, F. V. Insect Pests of Fruit, 1909, p. 117.

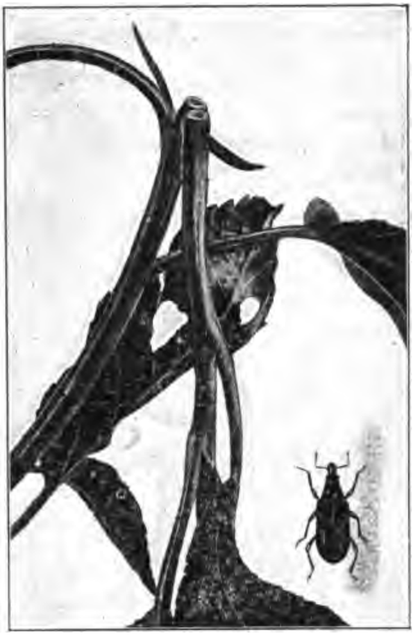


Fig. 80.—Plum twig-cutter (*Rhynchites cærulеus*): Adult and injury. (Theobald.)

### **Rhynchites cupreus** Linnæus.

(Plum Borer. Rhynchitidæ; Coleoptera.)

*Hosts:* Plum, prune, cherry.

*Injury:* Attacks young fruit.

*Description and biology: Adult,* length 3–4 mm., color bronze-copper. Occurs in autumn, hibernates in this stage and reappears in early spring. *Pupates* in ground. *Larva* develops in fruit, causing it to fall. *Eggs* are placed singly in young fruit at base of peduncle. (See text fig. 81.)

*Distribution:* Europe.

Henschel, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 81.

### **Brachyrhinus lævigatus** Fabricius (**Otiorhynchus**).

(Brachyrhinidæ; Coleoptera.)

*Host:* Plum.

*Injury:* To buds and young twigs.

*Description and biology: Adult,* length 6–6.5 mm.; black, shining, without hairs; neck-shield rather flat, disk punctured; wing covers finely furrowed.

*Distribution:* Middle Europe.

Henschel, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 109.

### **Magdalis armigera** Geoffroy.

(Plum Stem Piercer. Curculionidæ; Coleoptera.)

*Host:* Plum.

*Injury:* To twigs and foliage.

*Description and biology: Adult,* length 3.5–4.5 mm.; color, dull black; neck shield with thorn-like projections near fore margin, 4-cornered, hardly as wide as long, finely punctate; elytra strigose punctate, space between punctations flat; beak shorter than neck shield. Adult attacks leaves. *Larva* develops in twig. *Pupates* in burrow.

*Distribution:* Europe.

Henschel, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 94.

### **Curculio cerasorum** Herbst (**Balaninus**).

(Cherry Weevil. Curculionidæ; Coleoptera.)

*Host:* Cherry.

*Injury:* To fruit.

*Description and biology: Adult*, length 3–3.5 mm.; color clear brownish red; eyes black; prothorax and ventral surface covered with golden hairlike scales. *Larva* eats out cherry pit. *Pupation* takes place in pit.

*Distribution:* Germany.

Henschel, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 91.

### **Anthonomus rectirostris** Linnæus.

(Curculionidæ; Coleoptera.)

*Hosts:* Cherry and other fruits.

*Injury:* Attacks the fruit.

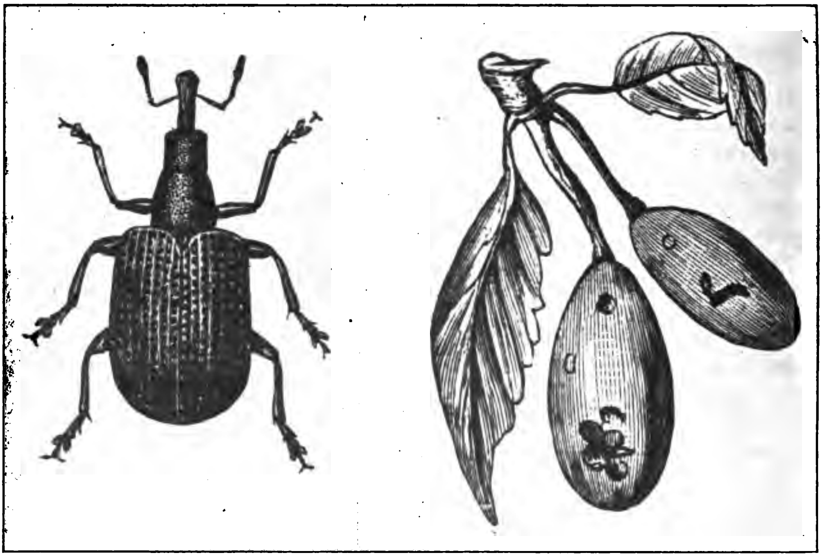


Fig. 81.—Plum borer (*Rhynchites cupreus*): Adult and injury. (Henschel.)

*Description and biology: Larva* feeds on seeds, preventing fruit from ripening. *Eggs* are deposited in young fruit.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d. ed., 1913, vol. 3, p. 556.

### **Scolytus assimilis** Boheman.

(Scolytidæ; Coleoptera.)

*Host:* Plum.

*Injury:* Attacks bark and sapwood. Very destructive.

*Description:* Habits similar to *S. rugulosus*.

*Distribution:* Argentina.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 572.

### **Scolytus pruni** Ratzeburg.

(Scolytidæ; Coleoptera.)

*Hosts:* Plum, pear, apple.

*Injury:* Destroys many trees, makes galleries under bark.

*Description and biology: Adult,* length 4 mm.; head and thorax black, elytra chestnut. Appears in June (France). *Pupates* in spring. *Larval* galleries perpendicular to maternal gallery. *Eggs* deposited in gallery under bark of weakened trees.

*Distribution:* Europe.

MONTILLOT, L. Les Insectes Nuisibles, 1891, p. 168.

GUENAUX, G. Entomologie et Parasitologie Agricoles, 1904, p. 340.

### **Coleophora anatipennella** Hübner.

(Cherry Tree Case-Bearer. Elachistidæ; Lepidoptera.)

*Hosts:* Cherry, apple, sloe.

*Injury:* Serious attacks at intervals of a few years; feeds on buds and early foliage.

*Description and biology: Adult,* wing expanse 12 mm.; forewings creamy white with scattered fuscous scales noticeable toward tips, fringe white; hind wings dusky, with long gray fringes. Occurs July to August. *Pupa* pale brown in color; pupation takes place in its case; period 3 or 4 weeks. *Larva,* length 12 mm.; reddish brown to orange with dark-brown shiny head. Larval case pistol-shaped, dark brown to black, with white border around mouth. Larvæ may be found from August through the winter until June. *Eggs* are deposited on under side of leaf, hatching in 2 or 3 weeks.

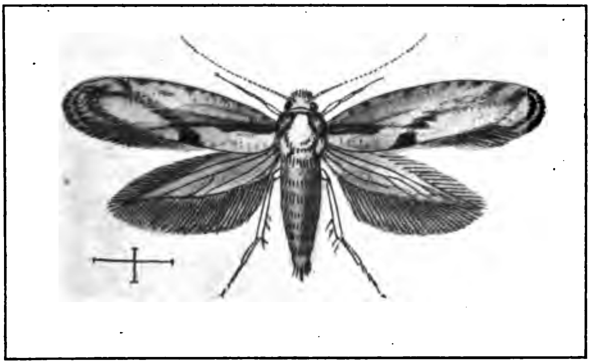


FIG. 82.—Cherry fruit moth (*Argyresthia nitidella*): Adult moth. (Theobald.)

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 195.

### **Argyresthia ephippella** Fabricius.

(Hyponomeutidæ; Lepidoptera.)

*Hosts:* Cherry, plum, hazel.

*Injury:* Not seriously destructive.

*Description and biology: Adult,* wing expanse 12 mm.; forewings ocherous brown, inner margin white, interrupted beyond middle by dark-brown spot, which can be traced across the wings as an oblique fascia terminating in the costa. *Larva* feeds on shoots, leaf, and blossom buds.

*Distribution:* Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 193.

### **Argyresthia nitidella** Fabricius.

(Cherry Fruit Moth. Hyponomeutidæ; Lepidoptera.)

*Hosts:* Cherry, hawthorn.

*Injury:* Seldom serious. Attack fruit just after it has set.

*Description and biology: Adult,* wing expanse 11 mm.; forewings light brown, with white or cream colored inner margins; in middle there is a fascia of deeper brown color which terminates in tip of wings. Occurs in May (Stainton). *Cocoon* dense and white; pupal period about 15 days. *Larva* light green; head, first thoracic segment and legs brown. *Eggs* placed on shoots near flower bud. Overwinters in egg stage. (See text fig. 82.)

*Distribution:* England.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 192.

### **Xylina ornithopus** Rott.

(Gray Plum Owlet Moth. Noctuidæ; Lepidoptera.)

*Host:* Plum.

*Injury:* Defoliation.

*Description and biology: Adult,* forewing 15–17 mm. long; grayish white mixed with weak brownish. Occurs August and September (Germany). *Pupates* in July in earth. *Larva* 33 mm. long; blue-green in color, marked with white spots; three white dorsal lines; head whitish green. Overwinters as *egg.*

*Distribution:* Europe.

Henschel, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 361.

### **Xylina socia** Rott.

(Brown Plum Owlet Moth. Noctuidæ; Lepidoptera.)

*Hosts:* Plum, elm, linden.

*Injury:* Defoliation.

*Description and biology: Adult,* forewing 17–20 mm. long; brown with a mixture of gray or rose color. Occurs August and September (Germany). *Pupates* in earth. *Larva* length 33 mm.; color apple-green; marked with white spots and a broad white dorsal stripe; head shining green. Overwinters as *egg.*

*Distribution:* Europe.

Henschel, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 361.

### **Laspeyresia funebrana** Treitschke.

(Red Plum Maggot. Tortricidæ; Lepidoptera.)

*Host:* Plum.

*Injury:* Attacks fruit; damage not easy to detect. "Caterpillar plentiful in plum pies." (Stainton.)

*Description and biology: Adult,* wing expanse about 12 mm.; forewings purplish gray, clouded with smoky gray; at anal angle is an indistinct, ocellated patch, edged with pale gray and inclosing four black dots. *Pupates* in whitish cocoon under rough bark or débris in spring. Pupa amber color. *Larva,* length 15 mm., chestnut red in color, with sides yellowish or entirely deep red. *Eggs,* placed at base of fruit stalk, hatching in 10 days. (See text fig. 83.)

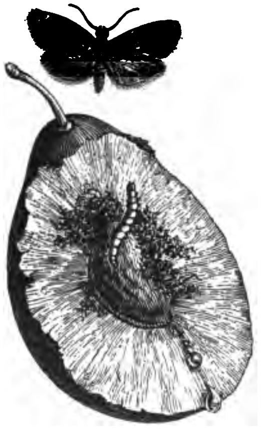


Fig. 83.—Red plum maggot (*Laspeyresia funebrana*): Moth and larva in fruit. (Henschel.)

*Distribution:* Europe, Asia Minor.

Theobald, F. V. Insect Pests of Fruit, 1909, p. 363.

### **Laspeyresia woeberiana** Schiffermiller.

(Bark Tortrix. Tortricidæ; Lepidoptera.)

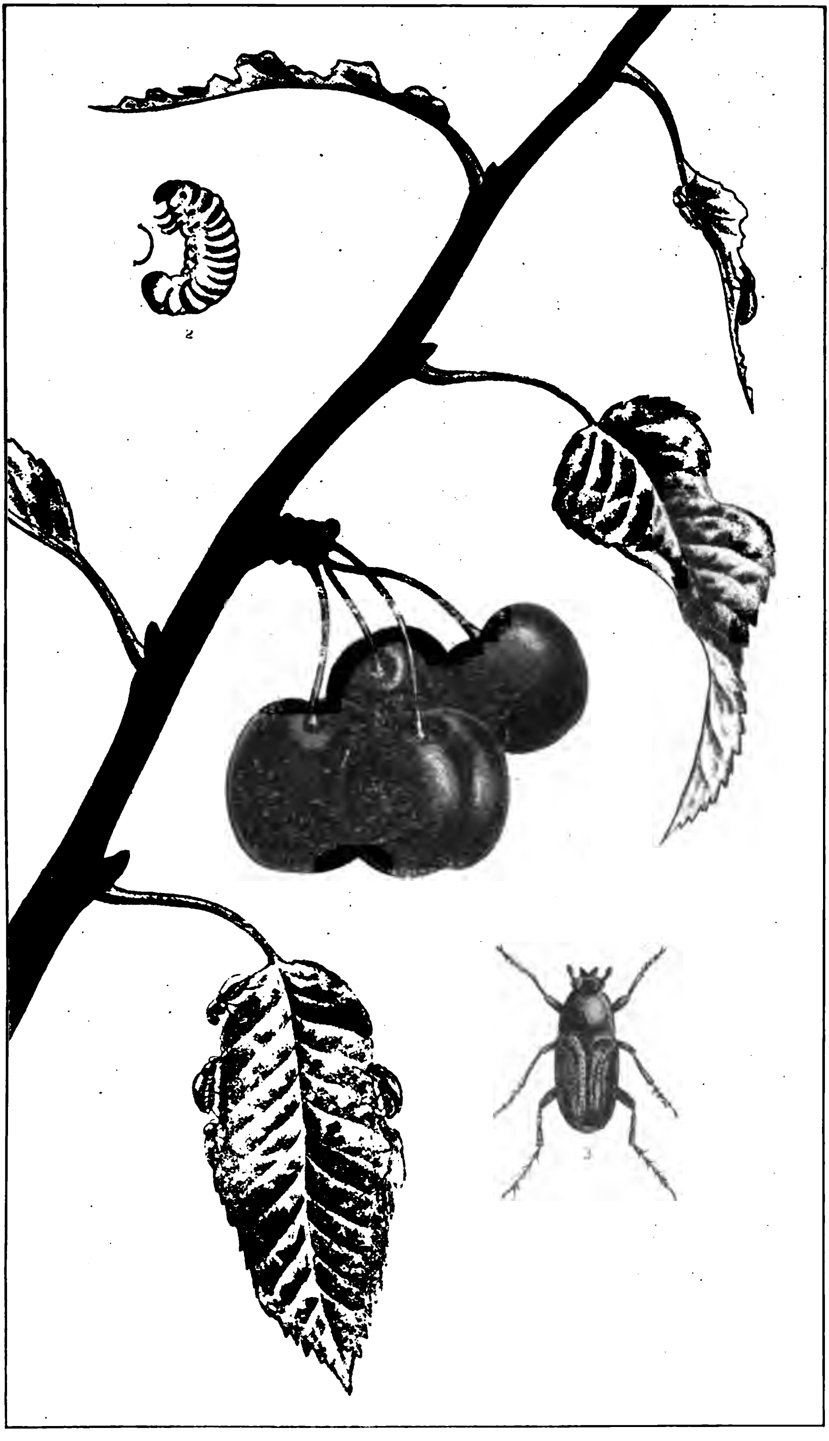
*Host: Prunus* sp. and other fruits.

*Injury:* Injury to bark.

*Description and biology: Adult,* wing expanse 16 mm., forewing dark brown, with rusty-yellow and lead-gray oblique lines; five white notches on fore margin, and a twisted lead line from the notches to the eye spot; speculum on a rusty-yellow ground, marked with black. Two broods, first May and June; second August and September (Germany). *Pupa* chestnut brown, pupates in larval gallery. *Larva* length 9 mm.; dirty green, red-headed, sparsely hairy. Feeds in galleries in bark; betrayed by masses of frass hanging out of air holes. *Eggs* placed in crevices in bark.

*Distribution:* Europe.

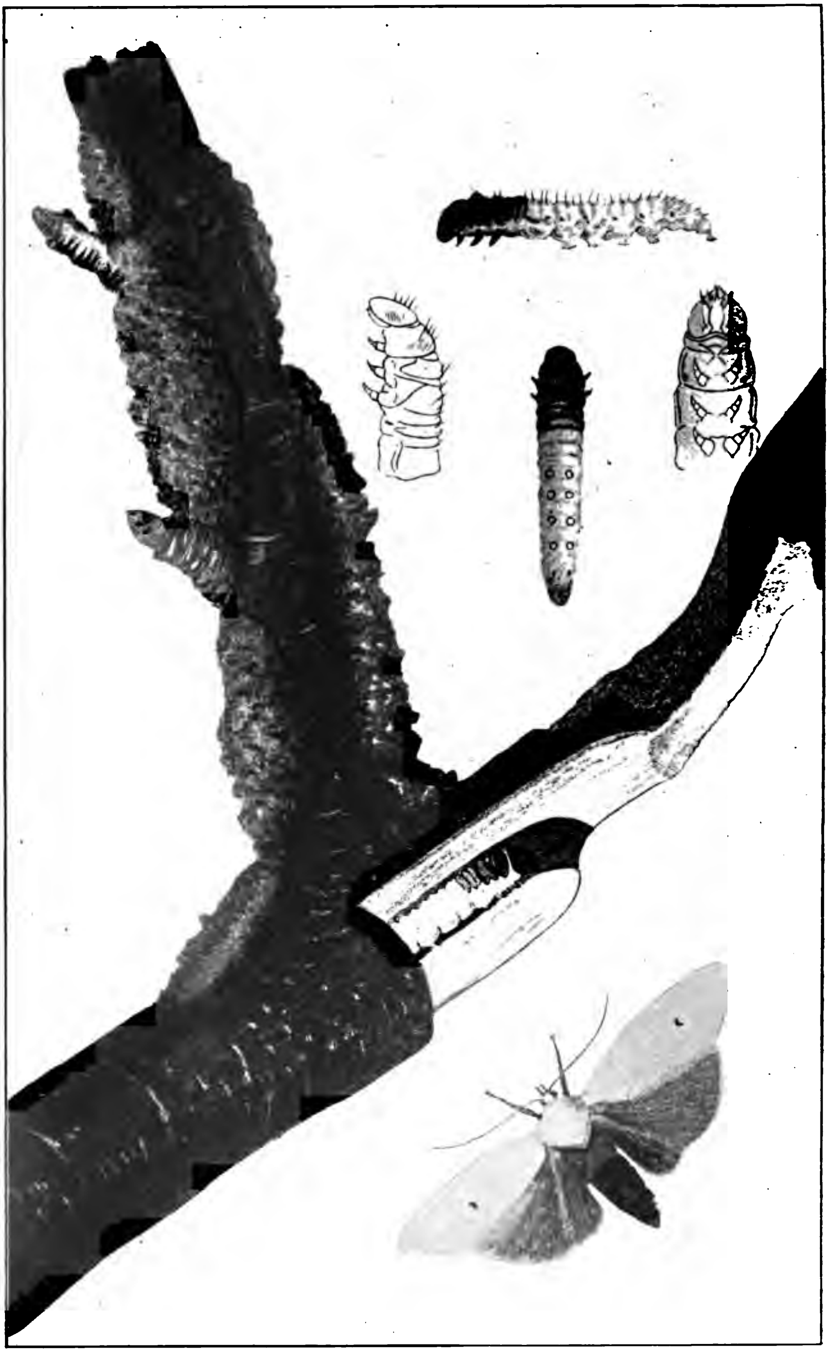
Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 283.



A DESTRUCTIVE CHERRY INSECT.

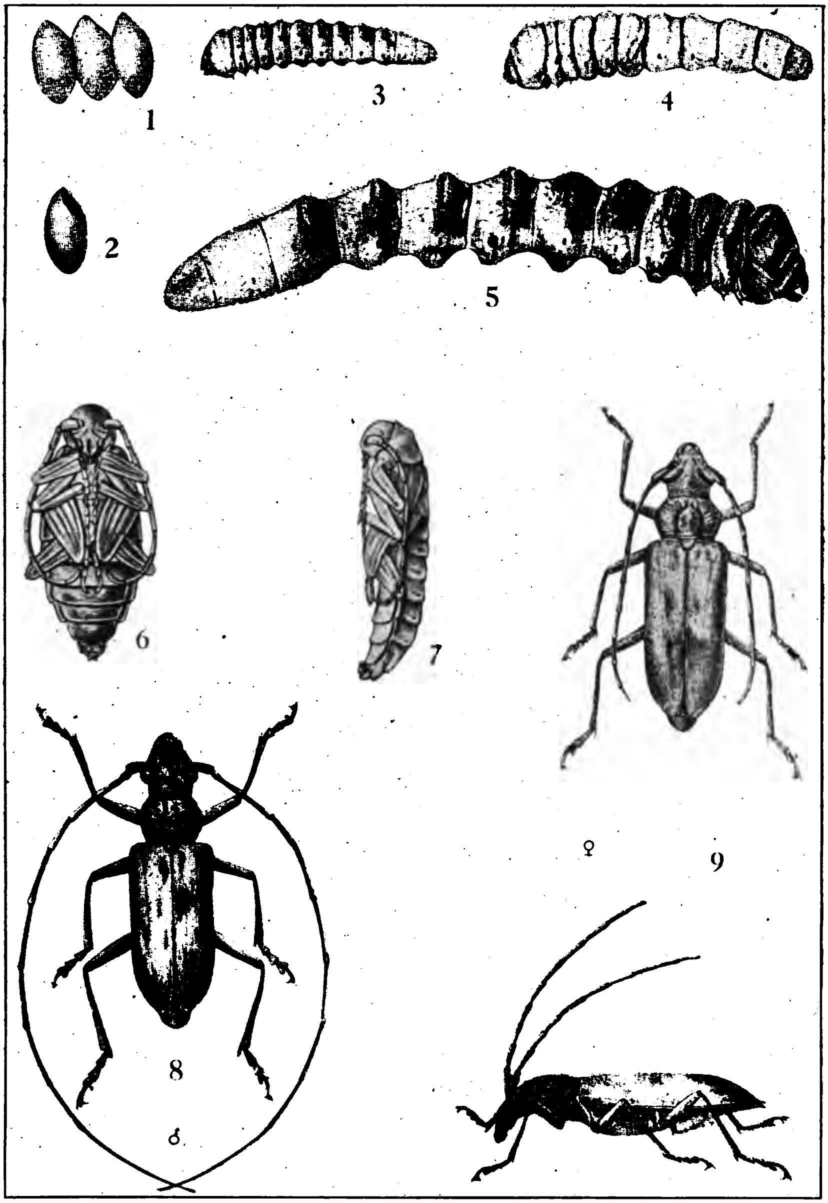
The cherry green beetle (*Diphucephala colaspidoides*): Adult, larva and injury (French.)

UNIV. OF M



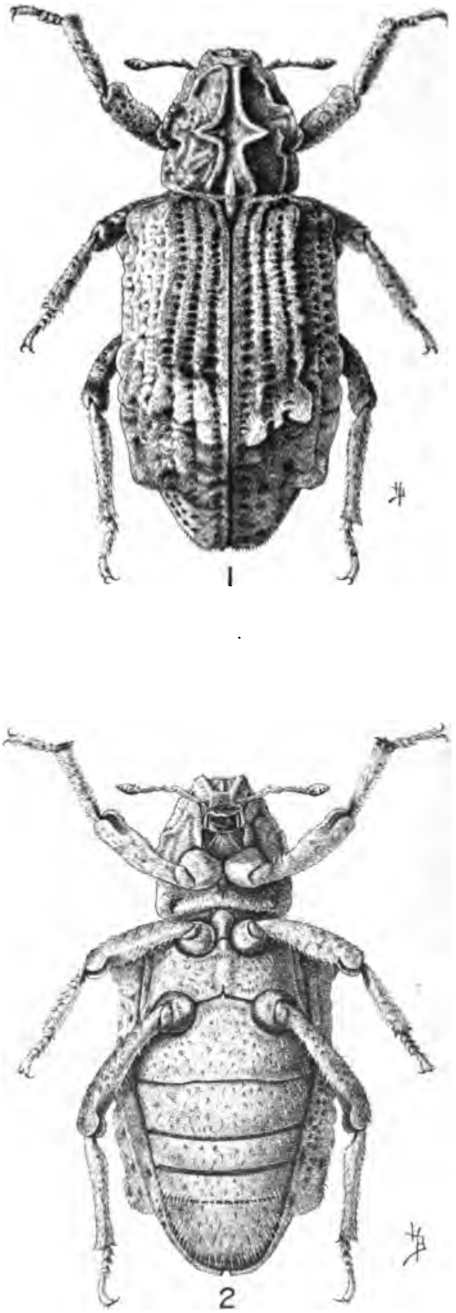
THE CHERRY BORER.

The cherry borer (*Cryptophaga unipuncta*): Moth, larva, pupa, and injury. (French.



A POPLAR BORER.

Poplar borer (*Æolesthes sarta*): FIG. 1.—Eggs. FIG. 2.—Empty egg. FIGS. 3, 4, 5.—Larval stages. FIGS. 6, 7.—Pupa. FIG. 8.—Male. FIG. 9.—Females. (Stebbing.)



POTATO WEEVIL. RHIGOPSIDIUS TUCUMANUS HELLER. (PIERCE.)

### **Cryptophaga unipunctata** Donovan.

(The Cherry Borer. Xyloryctidæ; Lepidoptera.)

*Hosts:* Cherry, peach, honeysuckle.

*Injury:* Very serious. Makes shallow tunnels in branches of trees.

*Description and biology: Adult,* wing expanse 37 mm.; a white satiny moth; front of head, antennæ, and a dot on forewings, black. *Larva,* length, 50 mm.; pinkish white, hairy; covers entrance to burrow with silken web in which collects the sawdust-like excrement. (See plate XXXIV.)

*Distribution:* Australia.

FRENCH, C. Handbook of Destructive Insects of Victoria, 1891, pt. 1, p. 113.
FROGGATT, W. W. Australian Insects, 1907, p. 277.

### **Olethreutes pruniana** Hübner.

(Plum Bud-moth. Tortricidæ; Lepidoptera.)

*Host: Prunus* sp.

*Injury:* To buds and shoots.

*Description and biology: Adult,* forewing 7–8 mm.; from middle of fore margin to inner angle, bluish black, mixed with brownish black; border third golden white clouded with brownish gray; apical point deep black; palpi grayish black; occurs June and July (Germany). *Pupates* in grass, or between leaves sewed together, during latter part of May. *Larva,* length 20 mm.; greenish yellow, head white, divided thoracic shield and anal lobes shining black; feeds in shoots and developing leaves drawn together; occurs in spring until middle of May. *Eggs* placed singly on buds. Overwinters in egg stage.

*Distribution:* Europe.

HENSCHEL, G. A. O. Die Schädlichen Forst- und Obstbaum-Insekten, 1895, p. 418.
MONTILLOT, L. Les Insectes Nuisibles, 1891, p. 176.

### **Hoplocampa fulvicornis** Panzer.

(Plum Fruit Sawfly. Tenthredinidæ; Hymenoptera.)

*Host:* Plum.

*Injury:* Frequently causes considerable damage. Attacks fruit and eats out interior. Causes fruit to fall.

*Description and biology: Adult,* wing expanse less than 8 mm.; color black, with yellow, yellowish-red or reddish-brown legs. *Pupates* in soil in brownish cocoon. *Larva,* length 12 mm.; creamy-white, sometimes slightly pinkish; head brown; caudal end somewhat attenuated and slightly curved. *Eggs* minute, greenish white and transparent; placed in unopened blossom; hatch in a few days. (See text, fig. 84.)

*Distribution:* England, Europe.

THEOBALD, F. V. Insect Pests of Fruit, 1909, p. 376.

### **Prophorus padi** Linnæus.

(Plum Leaf Sawfly. Tenthredinidæ; Hymenoptera.)

*Hosts:* Plum, pear, hawthorn, bramble, mountain ash, birch.

*Injury:* Important. Defoliation.

*Description and biology: Adult,* female, color mainly black; thorax shiny, covered with grayish brown and two dull white spots; abdomen with scattered, pale, very fine hairs; legs white, except middle of femora, apex of tibia and posterior tarsus, which are black. Two broods, frequently three. First brood occurs in May, second about middle of June. (England.) Active during warmest part of day. *Pupa* pale gray. Pupates in ground; period 9 to 12 days. *Larva*, green or grayish green, with almost white sides; head usually pale dull orange brown. Larval stage of first brood lasts 3 weeks; second brood overwinters in soil. *Eggs* are placed on under surface of leaves. Incubation requires 8 days. (See text fig. 85.)

*Distribution:* England, Europe.

Theobald, F. V. Insect Pests of Fruit, 1909, p. 372.

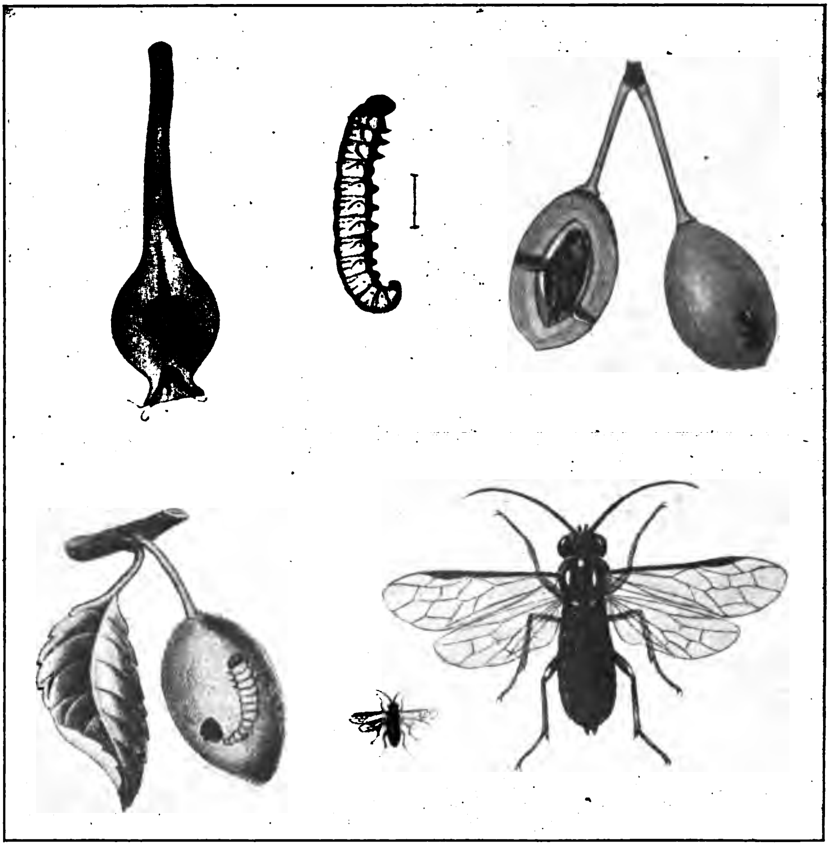


FIG. 84.—The plum fruit sawfly (*Hoplocampa fulvicornis*): Adult, larva, and injury. (Ent. Tidsk.)

## B. OTHER IMPORTANT PLUM AND CHERRY INSECTS.

### HEMIPTERA.

**Coccidæ.**

Armored—

*Aspidiotus* (*Diaspidiotus*) *patavinus* Berlese; Italy; *Prunus cerasus.*

**Diaspis pentagona* Targioni-Tozzetti; Italy, Japan, Cape Colony; *Prunus cerasus, P. pseudocerasus, P. armeniaca, P. laurocerasus.*

Unarmored—

*Kuwania parva* Maskell; Japan; *Prunus cerasus.*

*Lecanium cerasi* Goethe; Germany, England; *Prunus cerasus.*

*Lecanium cerasorum* Cockerell; Japan; *Prunus cerasus.*

*Lecanium coryli* Linnæus; Europe; *Prunus cerasus, P. armeniaca, P. avium, P. domestica, P. insititia, P. laurocerasus, P. padus, P. spinosa.*

**Coccidæ**—Continued.

Unarmored—Continued.

*Lecanium rugosum* Signoret; France, Germany; *Prunus cerasus.*

*Lecanium prunastri* Fonscolombe; plum, peach (see pl. IV, fig. 3).

*Pulvinaria betulæ* Linnæus; Denmark, England, Switzerland; *Prunus cerasus, P. armeniaca, P. domestica.*

**Lygæidæ.**

*Nysius vinitor* Bergroth; Australia; plum and cherry. (See Fruit.)

## COLEOPTERA.

**Bostrychidæ.**

*Apate monachus* Fabricius; Africa, West Indies. (See Citrus.)

**Buprestidæ.**

*Capnodis tenebrionis* Linnæus; Europe; bores in *Prunus spinosa.*

**Cerambycidæ.**

*Saperda scalaris* Linnæus; Europe; borer in cherry trees.

*Liopus nebulosus* Linnæus; Europe; borer in cherry trees.

*Uracanthus acutus* Blackburn; Europe. (See Peach.)

**Curculionidæ.**

*Leptops hopei* Schonherr; Victoria. (See Apple.)

*Magdalis carbonaria* Linnæus; Europe; plum. (See Birch.)

*Magdalis cerasi* Linnæus, and *M. pruni* Linnæus; Europe; bore under bark of cherry and plum.

*Curculio herbsti* Gemminger (*Balaninus*); Europe; breeds in fruit of cherry and plum.

*Curculio rubidus* Gyllenhal (*Balaninus*); Europe; breeds in fruit of plum.

*Anthonomus druparum* Linnæus; Europe; breeds in buds of plum and cherry.

**Scolytidæ.**

*Scolytus mali* Bechst; Europe; bores in trunk and branches of plum.

## LEPIDOPTERA.

**Noctuidæ.**

*Diloba cæruleocephala* Linnæus; Europe; plum, cherry. (See Apple.)

**Xyloryctidæ.**

*Cryptophaga unipunctata* Donovan; Australia; bores in cherry trees.

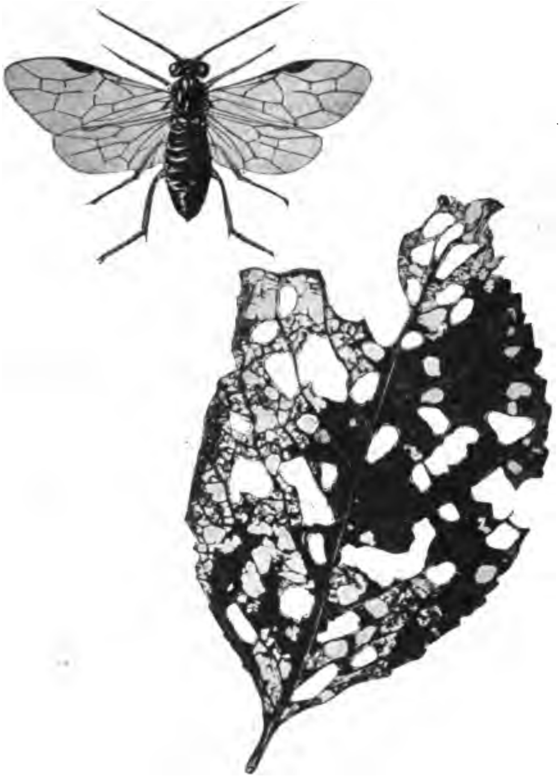


FIG. 85.—Plum leaf sawfly (*Priophorus padi*): Adult and injured leaf. (Theobald.)

**Tortricidæ.**

*Laspeyresia prunivorana* Ragonot; Europe; breeds in fruit.

*Olethreutes variegana* Hübner, Europe; feeds on buds and shoots.

**Geometridæ.**

*Hibernia rupicapraria* Hübner; Europe. (See Fruit.)

*Anisopteryx æscularia* Schiffermiller; Europe. (See Forests.)

*Biston hirtarius* Cl.; Europe; defoliator.

*Cheimatobia boreata* Hübner, and *C. brumata* Linnæus; Europe; defoliators

**Lasiocampidæ.**

*Gastropacha quercifolia* Linnæus; Europe. (See Fruit.)

**Lymantriidæ.**

*Teia anartoides* Walker; Australia; cherry. (See Fruit.)

**Hyponomeutidæ.**

**Hyponomeuta malinellus* Zeller and **H. padellus* Linnæus; Europe; introduced in United States; cherry. (See Apple.)

**Argyresthia conjugella* Zeller; Europe, British Columbia, Japan; attacks fruit of cherry and plum. (See Apple.)

### HYMENOPTERA.

**Tenthredinidæ.**

*Pamphilius flaviventris* Retz.; Europe. (See Pear.)

*Hoplocampa rutilicornis* Panzer, sawfly; mines in fruit; Europe.

### DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann, attacks fruit of *Prunus cerasus*. (See Fruit.)

*Anastrepha fraterculus* Wiedemann, attacks Japanese plum. (See Fruit.)

*Anastrepha ludens* Loew.; Mexico. (See Fruit.)

## POMEGRANATE.

(*Punica granatum*. Family Lythraceæ.)

A fruit-bearing tree of Asia, extensively cultivated throughout the world. Propagated by cuttings and seed.

### IMPORTANT POMEGRANATE INSECTS.

### LEPIDOPTERA.

**Lycænidæ.**

*Virachola isocrates* Fabricius; India; bores in fruit. (See Fruit.)

*Virachola livia* Klug, the pomegranate butterfly; Egypt; larvæ attacks fruit (Gough, L. H.: The Agric. Journ. Egypt, vol. 3, 1914, p. 105, pl. 8, figs. 5–7.)

**Pyralidæ.**

*Cryptoblabes gnidiella* Miller; Egypt; breeds in fruit (Gough, l. c., p. 104).

## POPLAR; ASPEN; COTTONWOOD.

(*Populus* spp. Family Salicaceæ.)

Soft-wooded trees of the Northern Hemisphere, often used in landscape gardening.

### A. BETTER KNOWN POPLAR INSECTS LIKELY TO BE IMPORTED.

### Saperda spp.

(Poplar Borers. Cerambycidæ; Coleoptera.)

*Species:* *S. carcharias* Linnaeus, poplar borer; Europe; poplar, willow, aspen. *S. populnea* Linnæus, aspen borer; Europe, Siberia, United States Pacific coast; aspen, poplar, willow. *S. scalaris* Linnæus; Europe; aspen, walnut, cherry, apple, beech.

*Injury:* The first two are very injurious species.

*Biology:* The egg is laid in the bark and the larva first bores in the bark but later goes into the wood. It pupates in the larval tunnel.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 505, 506.

### Trochilium spp.

(Hornet Moths. Sesiidæ; Lepidoptera.)

*Species:* *T. apiformis* Clerck; Europe; poplar (*Populus nigra, P. canadensis*); aspen (*Populus tremula* L.); ash. *T. amnatiæforme;* India; *Populus euphratica*.

*Injury:* Bore in wood.

*Description and biology:* *Moths* clear winged, wasplike in appearance. *Larva* bores in wood. *Pupates* in cell of frass near exterior.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 327.

Nüsslin, Otto. Leitfaden der Forstinsectenkunde, 2d ed., 1913, pp. 317, 318, fig. 269, a.

Stebbing, E. P. Manual Forest Zoology India, 1908, pp. 124, 125, fig. 255.

## B. OTHER IMPORTANT POPLAR INSECTS.

### HEMIPTERA.

**Aphididæ.**

*Pemphigus bursarius* Linnæus; Europe; foliage.

*Pemphigus immunis* and *P. napæus;* India; attacks the twigs of *Populus euphratica* and *P. tremula.*

*Pemphigus filaginis* Fonsc. (*marsupialis* Koch); Europe; forms pocket-shaped galls on the midrib of leaves of poplar.

*Pemphigus vesicalis* Koch; Europe; foliage of *Populus alba.*

*Asiphum tremulæ* De Geer; Europe; attacks young shoots, leaves and petioles of aspen (*Populus tremula*).

**Coccidæ.**

Armored—

*Chionaspis salicis* Linnæus; Europe; *Populus balsamifera, P. monilifera, P. nigra, P. tremula.*

*Crypthemichionaspis africana* Newstead; Egypt.

Unarmored—

*Ceroplastes rusci* Linnæus; Italy.

*Pulvinaria betulæ* Linnæus; Europe; *Populus alba, P. nigra, P. tremula.*

*Lecanium coryli* Linnæus; Europe; *Populus alba, P. tremula, P. virginiana.*

*Lecanium ciliatum* Douglas; Europe; *Populus alba, P. tremula.*

### COLEOPTERA.

**Anobiidæ.**

*Ptilinus fuscus* Geoffroy; Europe; bores in dead wood of standing living trees.

**Buprestidæ.**

∗*Agrilus viridis* Linnæus (see Oak) and *A. sexguttatus* Brahm.; Europe, bore in bark and branches of poplars and aspens.

*Capnodis miliaris* Klug; India; bores in *Populus euphratica.*

*Pœcilonota variolosa* Paykull; Europe; bores in bark of poplar and aspen.

*Melanophila picta* Pallas; South Europe, Algeria; bores in wood of young poplars.

**Scarabæidæ.**

*Amphimallon solstitialis* Linnæus; Europe; larvæ attack roots of small plants.

*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus; Europe; larvæ attack roots of seedlings.

**Cerambycidæ.**

*Æolesthes sarta* Solsky; India; bores in *Populus alba* and *P. euphratica.* (See pl. XXXV.)

*Lamia textor* Linnæus; Europe; bores in bark and larger cuttings of poplar and aspen.

*Saperda carcharias* Linnæus, *S. scalaris* Linnæus and ∗ *S. populnea,* Linnæus; Europe; bore in branches and trunk. The latter occurs on our Pacific Coast. (See text fig. 86.)

*Xylotrechus rusticus* Linnæus; Russia; bores in bark and sapwood.

*Purpuriiscenus wachanrui* Levrat; Baluchistan; bores in *Populus ciliata.*

**Chrysomelidæ.**

∗*Phyllodecta vitellinæ* Linnæus; Europe, America; leaf beetle. (See Willow.)

*Crepidodera aurata* Marsham; Europe; leaf beetle on *Populus laurifolia* and *P. alba.* (See Willow.)

**Curculionidæ.**

*Orchestes salicis* Linnæus; Europe; mines the leaves.

*Orchestes populi* Fabricius; Europe; mines the leaves of *Populus nigra* and *P. dilatata.*

∗ *Cryptorhynchus lapathi* Linnæus; Europe, Eastern United States; breeds in the stems and twigs.

**Ipidæ.**

*Xyleborus cryptophagus* Ratzeburg; Germany; ambrosia beetle of poplar and aspen.

### LEPIDOPTERA.

**Cossidæ.**

*Cossus cossus* Linnæus, goat moth; Europe; bores in wood. (*See* Willow.)

∗*Zeuzera pyrina* Linnæus; Europe; bores in wood. (See *Horse-chestnut.*)

**Geometridæ.**

*Hibernia aurantiaria* Esp., *H. defoliaria* Linnæus and *H. marginaria* Borckh.; Europe; defoliators.

**Lasiocampidæ.**

*Eriogaster lanestris* Linnæus, and *Malacosoma neustria* Linnæus; Europe; defoliators.

**Lymantriidæ.**

∗ *Euproctis chrysorrhœa* Linnæus, ∗*Lymantria monacha* Linnæus, ∗*Porthetria dispar* Linnæus, *Porthesia similis* Fuessly, *Stilpnotia salicis* Linnæus; Europe; defoliators. (See Forest defoliators.)

**Sesiidæ.**

*Sciopteron tabaniformis* Rott.; Europe; bores in base of trunk.

## HYMENOPTERA.

**Cimbicidæ.**

*Cimbex variabilis* Klug, sawfly; Europe; attacks leaves, and adults girdle twigs.

*Pseudoclavellaria amerinæ* Linnæus, a sawfly; Europe; attacks foliage.

**Tenthredinidæ.**

*Nematus* (*Crœsus*) *septentrionalis* Linnæus and *Trichiocampus viminalis* Fallen; Europe; sawflies.

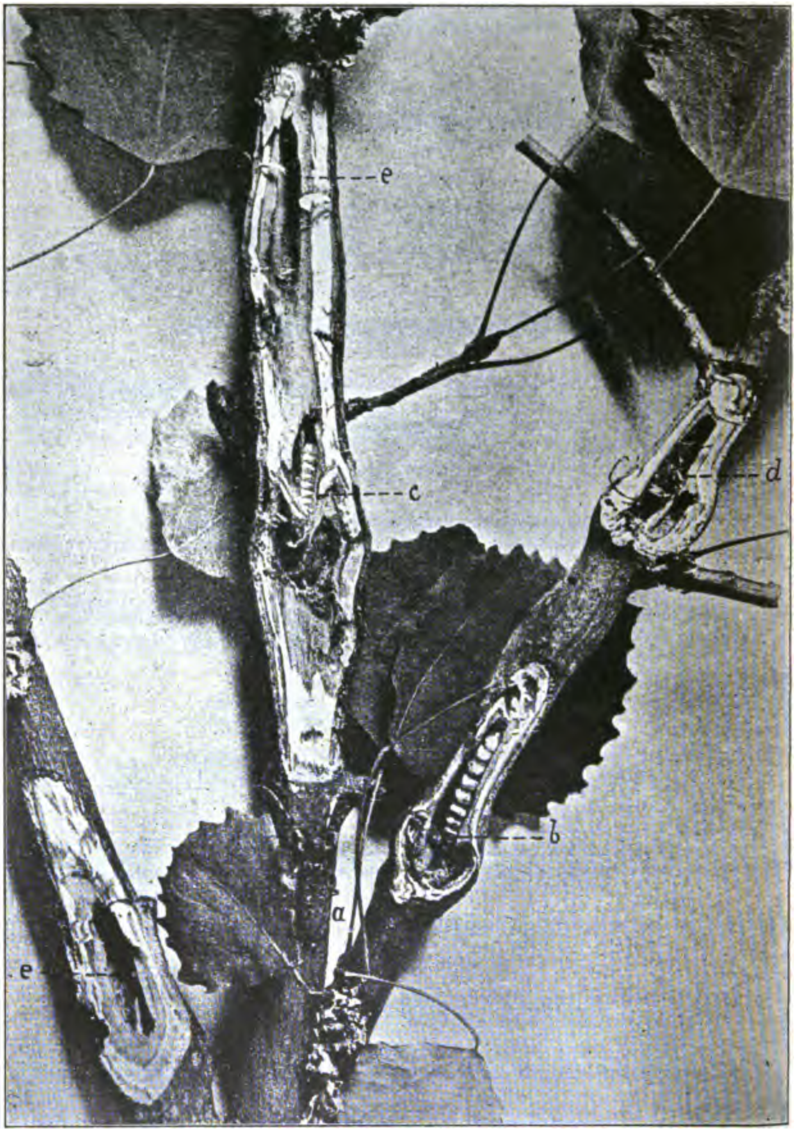


FIG. 86.—Poplar borer (*Saperda populnea*): Branch of aspen with galls containing larva, pupa, and adult. (Barbey.)

## DIPTERA.

**Itonididæ (Cecidomyiidæ).**

*Rhabdophaga saliciperda* Dufour; Europe; attacks *Populus alba*. (See Willow.)

### LITERATURE.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
NÜSSLIN, O. Leitfaden der Forstinsektenkunde, 2d ed., 1913.
HESS, R. Der Forstschutz, 1898, 1900.
STEBBING, E. P. Indian Forest Insects. Coleoptera, 1914.
BARGAGLI, P. Rassegna Biologica Rincofori Europei, 1883-1887.
LINDINGER, L. Die Schildläuse (Coccidæ), 1912.

## POTATO.

(*Solanum tuberosum* Linnæus. Family Solanaceæ.)

Although we grow many potatoes in the United States there has been a very large importation trade with other countries. Owing to the danger of introducing certain diseases especially, the Federal Horticultural Board has placed restrictions on the importation of potatoes. There are a number of important insect pests which need to be guarded against almost as closely as the diseases.

### A. BETTER KNOWN POTATO INSECTS LIKELY TO BE IMPORTED.

#### * Rhizoglyphus (Coepophagus) echinopus F. and R.

(Potato Root Mite. Tyroglyphidæ; Acarina.)

*Hosts:* Potato, parsnip, tulips, lilies, orchids, and many weeds.

*Injury:* Very destructive to roots and tubers.

*Description and biology:* A very tiny mite which breeds in roots and is quite destructive. It may readily be transported with root crops.

*Distribution:* France, Italy, Portugal, Palestine, Chile, Australia, California.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 109–111, figs. 82–86.

#### Epilachna spp.

(Potato Ladybird Beetles. Coccinellidæ; Coleoptera.)

*Species: E. 28-maculata* Motschulsky; China; potatoes, *Solanum* spp. *E. 28-punctata* Fabricius; Asia, Malaysia, Australia; Solanaceæ, Cucurbitaceæ. *E. dodecastigma* Mulsant; Asia, Malaysia, Australia; Solanaceæ Cucurbitaceæ. *E. territa* Mulsant; Java; Spanish peppers, Solanaceæ. *E. pusillanina* Mulsant; Java, Solanaceæ. *E. phyto* Mulsant; Java; Solanaceæ. *E. guttato-pustulata* Fabricius; Australia; potato.

*Injury:* Attack foliage in larval and adult stage.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 2d ed., 1913, vol. 3, p. 477.

#### Rhigopsidius tucumanus Heller.

(Argentine Potato Weevil; Psaliduridæ [Byrsopidæ]; Coleoptera.)

*Host:* Potato.

*Injury:* Bores in potato, making it unfit for use. Has been received alive in the United States in South American potatoes.

*Description and biology: Adult* weevil, light brown or grayish, with roughened elytra and short broad beak which rests in a deep groove in front of the anterior legs. Length 9 mm. *Pupa* white with rudiments of all appendages folded on the underside. Found in the potato. *Larva* white legless with chitinized brownish yellow head. Bores in the tubers. (See plate XXXVI.)

*Distribution:* Argentina, Peru, Bolivia, Chile.

PIERCE, W. DWIGHT. Journ. Agr. Research, vol. 1, No. 4, pp. 350, 351, pls. 39–40.

### Premnotrypes solani Pierce.

(Peruvian Potato Weevil. Brachyrhinidæ [Otiorhynchidæ]; Coleoptera.)

*Host:* Potato.

*Injury:* Bores in the tubers. Has been received alive in the United States in potatoes from Peru.

*Description and biology: Adult* weevil bronzy brown somewhat tuberculate with the thorax narrower than the elytra; beak moderately long. Length 7 mm. *Pupa* white with rudiments of all appendages folded on the underside. Found in the potato. *Larva* white, legless, with chitinized brownish yellow head. Bores in the tubers. (See plate XXXVII, figs. 1, 2.)

*Distribution:* Peru.

PIERCE, W. DWIGHT. Journ. Agr. Research, vol. 1, No. 4, pp. 346, 349, text figs. 1, 2; pl. 41, figs. 1, 2.

### Trypopremnon latithorax Pierce.

(Peruvian Potato Weevil. Brachyrhinidæ [Otiorhynchidæ]; Coleoptera.)

*Host:* Potato.

*Injury:* Bores in the tubers. Has been received alive in the United States in potatoes from Peru.

*Description and biology: Adult* weevil brown, tuberculate, with a very broad prothorax, scrobes abruptly terminated behind, mandibles with a tooth beneath. Length 6 mm. *Pupa* white with rudiments of all appendages folded on the underside. Found in the potato. *Larva* white, legless, with chitinized brownish yellow head. Bores in the tubers. (See plate XXXVII, fig. 3.)

*Distribution:* Peru.

PIERCE, W. DWIGHT. Journ. Agr. Research, vol. 1, No. 4, pp. 349–350, text fig. 3; pl. 41, fig. 3.

### Hypera (Phytonomus) spp.

(Potato Leaf Weevils. Curculionidæ; Coleoptera.)

*Species: H. variabilis* Herbst; breeds on the leaves of potato, clover, etc., and attacks bean, cabbage, service berries, *Plantago lanceolata, Atriplex patula. H. crinita* Boheman; Algeria and Tunis; breeds on potato.

*Injury:* These are potentially important pests. Judging from the ease with which the clover pests of this genus have been imported it is important to guard against these weevils.

*Description and biology:* Similar in form to the well-known clover-leaf weevil, *Hypera punctata.* The larvæ feed externally on the leaves and pupate in silken cocoons.

## B. OTHER IMPORTANT POTATO INSECTS.

### HEMIPTERA.

**Miridæ (Capsidæ).**

*Phytocoris pabulinus* Linnæus; Europe; sucks juices of stems.

**Jassidæ.**

*Eupteryx solani* Curtis; Europe; injures leaf.

### COLEOPTERA.

*Bathyscia wollastoni* Janson, the pigmy potato beetle; Europe, often a serious pest.

**Elateridæ.**

*Agriotes lineatus* Linnæus. (See Tobacco.)
*Lacon murinus* Linnæus; Europe; wireworm.

**Meloidæ.**

*Zonabris floralis* Pallas, *Z. 14-punctata* Pallas, *Epicauta rufidorsum* Goeze and *E. sibirica* Pallas, blister beetles; Europe; very destructive.

**Curculionidæ.**

*Hypera variabilis* Herbst; Europe. (See Clover.)
*Desiantha nociva* Lea; Australia; larvæ and adults destroy young plants. (See Tomato.)

## LEPIDOPTERA.

*Euchelia jacobeæ,* the cinnabar moth; Europe, injurious.

**Sphingidæ.**

*Acherontia atropos* Linnæus; death's head moth; Europe; larvæ feed on potato. (See text figs. 87, 88.)

**Hepialidæ.**

*Hepialus lupulinus* Linnæus; Europe; breeds at roots.
*Hepialus humuli* Linnæus; Europe. (See Hops.)

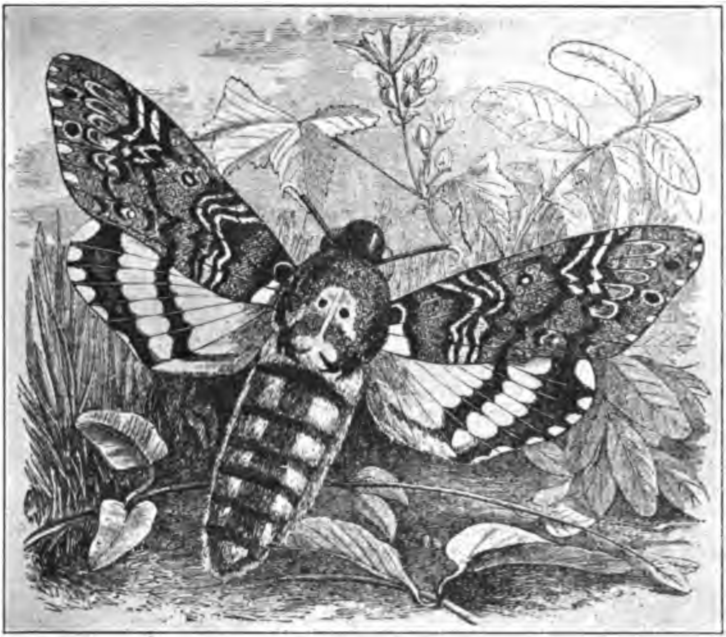


FIG. 87.—Death's-head hawk-moth (*Acherontia atropos*): Adult somewhat reduced. (Kirby.)

**Noctuidæ.**

* *Hydrœcia micacea* Esp.; the rosy rustic; Europe, Canada; potato-stalk borer.
*Gortyna ochracea* Hübner; Europe; stalk borer.
*Gortyna flavago* Newman; Europe; stalk borer.
*Persectania evengi,* Australia; climbing cutworm.
*Agrotis spina,* Bugong moth; Australia; cutworm.
*Euxoa radians,* Australia; cutworm.
*Euplexis nigerrima,* Australia; cutworm.

**Pyralidæ.**

*Lineodes ochracea.*
*Pachyzancla phæopteralis,* Bermuda.

## DIPTERA.

**Sapromyzidæ.**

*Lonchæa splendida* Loew, New Zealand, Australia, Oceanica. (See Tomato.)

## PRICKLY PEAR; TUNA; BARBARY FIG.

(*Opuntia* spp. Family Cactaceæ.)

The common broad-leafed cacti or prickly pears often yields edible fruit.

### IMPORTANT PRICKLY-PEAR INSECT.

DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann; attacks *Opuntia tuna,* and *O. vulgaris.* (See Fruit.)

## PURSLANE.

(*Portulaca oleracea.* Family Portulacaceæ.)

LEPIDOPTERA.

Low, fleshy, perennial or annual herbs mostly American. The purslane is cultivated for its edible foliage. Other species are cultivated for their flowers.

### IMPORTANT PURSLANE INSECT.

LEPIDOPTERA.

**Pyralidæ.**

* *Hellula undalis* Fabricius; Europe, Australia, parts of United States. (See Cabbage.)

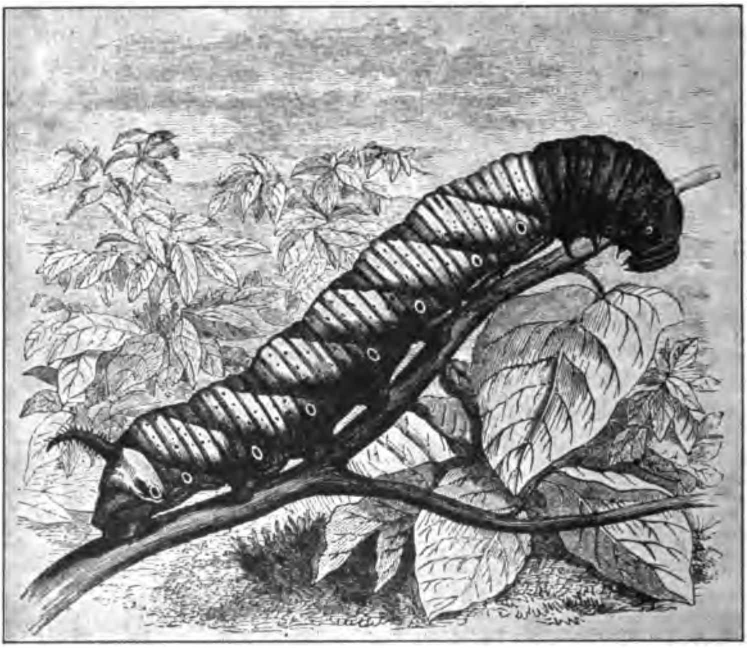


FIG. 88.—Death's-head hawk-moth (*Acherontia atropos*): Larva. (Kirby.)

## QUINCE.

(*Cydonia oblonga*, etc. Family Rosaceæ.)

Ornamental shrubs and trees from Asia now widely cultivated. *C. oblonga*, the quince, yields a fruit used in preserves. *C. japonica* is much prized as an ornamental shrub.

### IMPORTANT QUINCE INSECTS.

HEMIPTERA.

**Coccidæ.**

*Lecanium rugosum* Signoret; Europe.
* *Lecanium persicæ* Fabricius; Europe, Australia, California.
*Lecanium coryli* Linnæus; Europe.
*Aspidiotus* (*Diaspidiotus*) *africanus* Marlatt; South Africa.

COLEOPTERA.

**Curculionidæ.**

*Magdalis barbicornis* Latreille; Europe. (See Apple.)
*Magdalis pruni* Linnæus; Europe; bores under bark.

LEPIDOPTERA.

**Cossidæ.**

*Cossus tristis* Dru.; Africa. (See Apple.)

DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann. (See Fruit.)
*Bactrocera tryoni* Froggatt; Orient. (See Fruit.)

## RADISH.

(*Raphanus* spp. Family Cruciferæ.)

Cultivated root crops native of Europe and Asia. Grown from seed. (See Crucifers.)

### A. A RADISH INSECT LIKELY TO BE IMPORTED.

#### * **Anthomyia radicum** Meigen.

(Radish Fly. Anthomyidæ; Diptera.)

*Hosts:* *Raphanus* spp. (including radish), *Brassica* spp. (cabbage, etc.).

*Injury:* Breeds in the roots.

*Description and biology: Male fly* blackish, female ash gray; scutellum blackish with three black streaks; abdomen light gray, with black medium streak; undersides and face white in male, front triangle and all appendages black; wings clear; length 4.5–5.5 mm. *Maggot* whitish, 6 mm. long. *Pupates* in soil.

*Distribution:* Europe, and has been introduced into North America.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 425.

### B. OTHER IMPORTANT RADISH INSECTS.

COLEOPTERA.

**Curculionidæ.**

*Ceutorhynchus assimilis* Paykull; Europe; breeds in seed pod.
*Ceutorhynchus raphini* Fabricius; Europe; breeds in stem.
*Ceutorhynchus robertii* Gyllenhal; Europe; breeds in crown gall on *Raphanus raphanistrum*.

LEPIDOPTERA.

**Pyralidæ.**

*Evergestis extimalis* Sc. (See Rape.)

## RAPE.

(*Brassica napus* Linnæus. Family Cruciferæ.)

An important forage and cover crop; also valuable for the oil compressed from the seed.

### A. BETTER KNOWN RAPE INSECTS LIKELY TO BE IMPORTED.

#### **Phyllotreta vittula** Redtenbacher.

(Rape and Grain Beetle. Chrysomelidæ; Coleoptera.)

*Hosts and injury:* Mines leaves of *Setaria;* adults feed on beets and rape (Hungary); larva in base of stems of barley, rye, and wheat, causing much damage (Scandinavia; Russia).

*Description:* Beetle striped with yellow.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 525.

**Psylliodes chrysocephala** Linnæus; **Psylliodes napi** Fabricius.

(Rape Flea Beetles. Chrysomelidæ; Coleoptera.)

*Hosts:* Crucifers, rape, cabbage, etc.

*Injury:* Adults feed on foliage, flowers, and fruit.

*Biology: Eggs* are laid in the leaf axils. *Larvæ* bore into stem and roots. Breed continuously through season.

*Distribution:* Europe.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 523.

**Evergestis extimalis** Sc.

(Rape Seed Worm. Pyralidæ; Lepidoptera.)

*Hosts:* Rape, radish, cabbage.

*Injury:* Feeds on the seed, spinning a web among the fruiting heads.

*Description and biology: Moth,* wing expanse 26 mm., forewings light yellow ochraceous, with two rusty-brown transverse lines, violet-gray fringe. *Larva* yellowish green, with lateral gray stripe and four dorsal rows of dark-brown spots; head and thoracic shield black; 18 mm.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 308.

### B. OTHER IMPORTANT RAPE INSECTS.

COLEOPTERA.

**Nitidulidæ.**

*Meligethes æneus* Fabricius; Europe; larvæ feed on young shoots.

**Curculionidæ.**

*Ceutorhynchus assimilis* Paykull; Europe; breeds in fruit.

* *Ceutorhynchus quadridens* Panzer; Europe; Long Island, N. Y. breeds in roots.

*Ceutorhynchus sulcicollis;* Europe; forms galls on roots. (See text fig. 89.)

LEPIDOPTERA.

**Hepialidæ.**

*Hepialus humuli* Linnæus; Europe. (See Hops.)

DIPTERA.

**Itonididæ.**

*Dasyneura brassicæ* Winner; Europe; attacks fruit. (See Cabbage.)

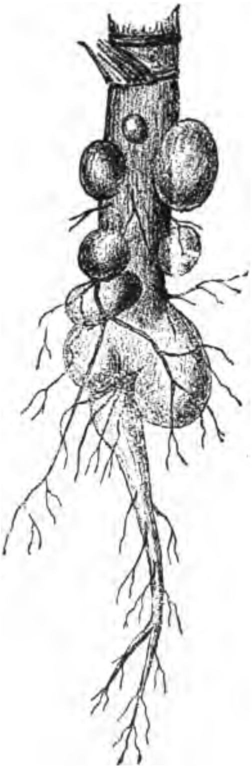


Fig. 89.—Galls of *Ceutorhynchus sulcicollis* on rape. (Ritzema Bos.)

## RASPBERRY.

See Blackberry.

## RATTAN.

(*Calamus* spp. Family Palmaceæ.)

Palms of tropical Asia, some of which are used to furnish rattan canes. They make excellent conservatory plants.

### IMPORTANT RATTAN INSECTS.

COLEOPTERA.

**Lyctidæ.**

*Lyctus brunneus* Stephens; Europe, Australia; bores in furniture and sapwood on unseasoned timber

LITERATURE.

Froggatt, W. W. Australian Insects, 1907.

## RHUBARB.

(*Rheum rhaponticum*, etc. Family Polygonaceæ.)

Robust perennial herbs originating in Asia and Russia. The rhubarb plant has been developed into several garden varieties. Propagated by root division or from seed.

### IMPORTANT RHUBARB INSECTS.

COLEOPTERA.

**Chrysomelidæ.**

*Chætocnema concinna* Marsh; flea-beetle; Europe. *Phyllotreta nemorum* Linnæus; Europe. (See Crucifers.)

**Curculionidæ.**

*Hypera rumicis* Linnæus; Europe; breeds on leaves.

## RICE.

(*Oryza sativa* Linnæus. Gramineæ.)

Rice is still an important product for importation in spite of the steadily increasing production in our own country. The principal sources of importation are Japan, China, India, Mexico, and Honduras. The danger of importing rice insects is twofold, through the grain itself, husked or unhusked, and its original containers, and through rice stalks used in packing fragile articles of commerce. The similarity of rice and grain insects lends importance to any rice pest introduced into the United States.

### A. RICE INSECTS LIKELY TO BE IMPORTED.

#### Schoenobius bipunctifer Walker.

(Rice Stem Borer. Lepidoptera.)

*Host*: Rice.

*Injury:* Bores in stalks, causing infertility.

*Description and biology*: *Adult moth*, straw-yellow color, the forewings having one black dot on each. Body about one-half inch in length, wing expanse about 1 inch. *Pupa* in silken case in straw. *Larva* bores in the stalk and remains in the stubble from November to June. *Eggs* laid in clusters on the leaves, covered with hairs; hatch in a week.

*Distribution:* India.

S. K. Basu and H. L. Dutt. Crop Pest Handbook for Behar and Orissa, 1913. Dept. Agr. Behar and Orissa, Calcutta, leaflet 6, pl. 6.

#### Chilo auricilia Dudgeon.

(Rice Stem Borer. Pyralidæ; Lepidoptera.)

*Host:* Rice, sorghum, corn, sugar cane, *Pennisetum*.

*Injury:* Bores in stems of grasses.

*Description and biology: Adult moth* with metallic spots on fore wings. *Larva* whitish with black head, thoracic shield and setigerous spots, and with purplish brown stripes.

*Distribution:* India.

Maxwell-Lefroy, H. F. Mem. Dept. Agric. India. Ent. Ser., vol. 1, pt. 2, p. 197.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 1913, 3d ed., vol. 3, p. 316.

### B. OTHER IMPORTANT RICE INSECTS.

The rice plant has many pests which attack the leaves, stalks, and roots, but which are not very likely to be imported. It is, however, of importance to briefly mention these in view of unforeseen possibilities of importation.

## ORTHOPTERA.

**Acrididæ and Locustidæ.**

*Hieroglyphus banian* Fabricius; India. (See Pl. XXXVIII.)

*Xiphidium varipenne;* Hawaii.

*Oxya velox* Fabricius; Hawaii, Formosa.

*Oxya intricata* Stål, and *Racilia okinawensis* Matsumura: Formosa and Orient.

**Gryllotalpidæ.**

*Gryllotalpa africana* Beauvais; Hawaii, Africa, Formosa, Asia, Australia, New Zealand.

## HEMIPTERA.

**Jassidæ, Cercopidæ and Fulgoridæ.**

*Deltocephalus dorsalis* Motschulsky; Formosa.

*Tettigoniella spectra* Distant; India. (See text fig. 90.)

*Zygina subrufa* Motschulsky and *Ptyelus costalis* Walker; Formosa.

*Dictyophora sinica* Walker, *Diostrombus politus* Uhler, *Nisia atrovenosa* Lethierry, *Delphax furcifera* Horvath, *Zygina maculifrons* Motschulsky, *Cicadula fasciifrons* Stål, *C. 6-notata* Fallen, *Nephotettix apicalis* Motschulsky, and *Tetigonia viridis* Linnæus; Formosa and Orient.

**Capsidæ.**

*Lygus oryzæ* Matsumura; Formosa, Orient.

**Coreidæ.**

*Leptocorisa varicornis* Fabricius; Japan, China, India, Philippines, Ceylon. (See text fig. 91.)

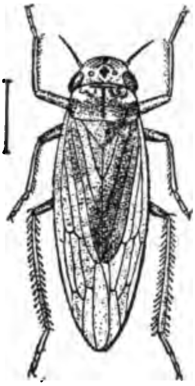


FIG. 90.—Rice leafhopper (*Tettigoniella spectra*): Adult. (Maxwell-Lefroy.)

**Pentatomidæ.**

*Aenaria lewisi;* Japan.

*Plantia affinis* Dallas; New South Wales.

## COLEOPTERA.

**Cucujidæ.**

*Læmotmetus rhizophagoides* Walker; Ceylon, Germany; injures dry rice and grain.

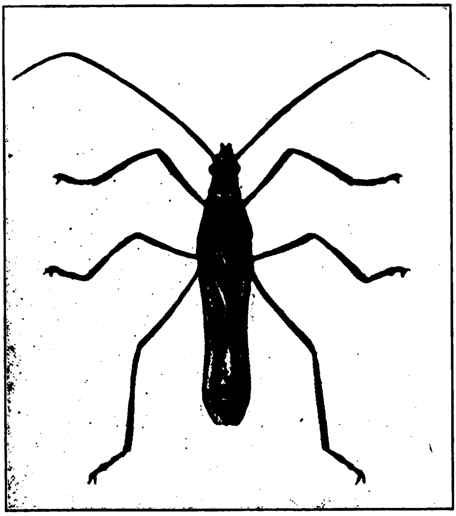


FIG. 91.—Rice bug (*Leptocorisa varicornis*): Adult. (Maxwell-Lefroy.)

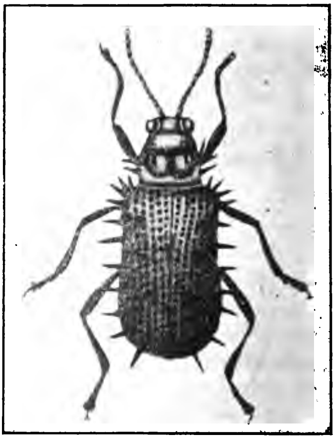


FIG. 92.—Rice leaf-beetle) *Hispa aenescens*): Adult. (Maxwell-Lefroy.)

**Scarabæidæ.**

*Anomala vitis* Fabricius; India; root borer.

*Phyllognathus dionysius* Fabricius; India; root destroyer. (See Pl. XXXIX.)

**Chrysomelidæ.**

*Hispa ænesçens* Baly; Assam, Burma, Bengal, Malabar. (See text fig. 92.)

*Hispa callicantha;* Japan.

**Chrysomelidæ**—Continued.
- *Chætocnema basalis* Baly; India; flea-beetle. (See text fig. 93.)
- *Lema flavipes* Suffrian; Japan.

**Curculionidæ.**
- *Echinocnemis squameus* Billberg; Formosa; root weevil.
- *Hypomeces unicolor* Fabricius; Java.

LEPIDOPTERA.

**Pyralidæ.**
- *Chilo simplex* Butler; India, Formosa. (See Sugar cane.)
- *Nymphula depunctalis* Guénée; rice case bearer; India, Burma, Ceylon, Java, Australia; feeds on leaves. (See pl. XL.)
- *Nymphula fluctuosalis* Zeller; India.
- *Melissoblaptes gularis* Zeller; Japanese grain moth; Japan, England; larvæ injure stored rice.

**Noctuidæ.**
- *Prodenia litura* Fabricius; India, Egypt; the cotton worm.
- *Spodoptera mauritia* Boisduval; Africa, Asia, Australia; army worm.
- *Nonagria inferens* Walker; Formosa, Orient.

**Hesperidæ.**
- *Parnara mathias* Fabricius; India; the rice skipper. (See pl. XLI.)

**Galleriidæ.**
- *Paralipsa modesta* Butler; Japan, Hawaii; larvæ injure stored rice.

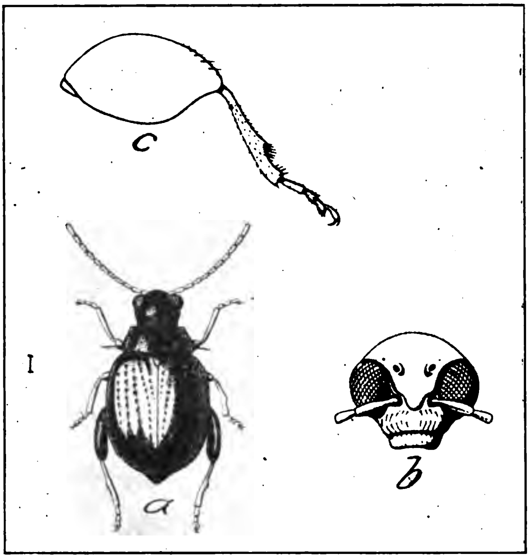


FIG. 93.—Rice flea-beetle (*Chætocnema basalis*): *a*, Adult, *b*, head, enlarged; *c*, hind leg, enlarged. (Maxwell-Lefroy.)

## ROSE.

(*Rosa* spp. Family Rosaceæ.)

Ornamental deciduous shrubs bearing beautiful flowers, much imported in nursery stock.

### A. AN IMPORTANT ROSE INSECT LIKELY TO BE IMPORTED.

**Adoretus umbrosus** Fabricius and its var. **tenuimaculatus** Waterhouse.

(The Japanese Rose Beetle. Scarabæidæ; Coleoptera.)

*Hosts:* Rose trees, citrus, grape, cotton, sugarcane.

*Injury:* Injurious to citrus, rose, grape, etc., in Hawaii, Rose trees in Fiji, and sugar cane in Java, devouring the foliage. The larvæ feed at the roots. May be introduced in the soil.

*Biology:* The adult is nocturnal in habit, hiding beneath the soil in the day and emerging in swarms at night. Larval stage, 17 days, pupal stage about 10 days, and egg stage from 6 to 8 days.

*Distribution:* Hawaii, Fiji, Japan, Java.

FULLOWAY, D. T. Hawaii Agr. Exp. Sta. Bull. 18, p. 11.

### B. OTHER IMPORTANT ROSE INSECTS.

HEMIPTERA.

**Coccidæ.**

Unarmored—
- *Lecanium pulchrum* Marchal; Germany, *Rosa arvensis.*
- *Lecanium perornatum* Cockerell and Parr.; Austria; *Rosa canina.*

**Coccidæ**—Continued.

Unarmored—Continued.

*Icerya montserratensis* Riley and Howard; Trinidad, Jamaica, Panama, Colombia, Nicaragua, Porto Rico.

*Icerya seychellarum* Westwood; China, Mauritius, Natal, England.

*Lecaniodiaspis sardoa* Targioni; Algeria.

*Rhizœcus falcifer* Künckel; Algeria, Sicily.

Armored—

**Leucaspis japonica* Cockerell; *Rosa lævigata*. Has been introduced and is established in the United States.

*Aspidiotus* (*Pseudaonidia*) *articulatus* Morgan; Peru.

*Aspidiotus* (*Chrysomphalus*) *dictyospermi pinnulifera* Maskell; Sicily, Italy, etc.

*Parlatoria calianthina* Berlese and Leonardi; Italy.

*Parlatoria proteus virescens* Maskell; China, Japan, Formosa.

*Aspidiotus* (*Pseudischnaspis*) *bowreyi* Cockerell; St. Thomas.

*Aspidiotus tayabanus* Cockerell; Philippine Islands.

### THYSANOPTERA.

**Heliothrips rubrocinctus* Giard; West Indies, Ceylon, Uganda, Florida. (See Fruit.)

### COLEOPTERA.

**Buprestidæ.**

*Agrilus viridis* Linnæus; Europe; breeds in stalks. (See Oak.)

**Chrysomelidæ.**

*Haltica quercetorum* Foudr.; Europe; attacks tea rose. (See Oak.)

**Cerambycidæ.**

*Vesperus strepens* Fabricius; France. (See Grape.)

**Brachyrhinidæ.**

*Diaprepes abbreviatus* Linnæus; West Indies. (See Sugar cane.)

### LEPIDOPTERA.

**Geometridæ.**

*Anisopteryx æscularia* Schiffermiller; Europe; feeds on foliage.

*Hibernia defoliaria* Linnæus; Europe; defoliator.

*Boarmia gemmaria* Brahm.; Europe. (See Grape.)

**Lasiocampidæ.**

*Malocosoma neustria* Linnæus; Europe; defoliator.

**Lymantriidæ.**

*Dasychira pudibunda* Linnæus and *Euproctis chrysorrhœa* Linnæus; Europe; defoliators. (See Forest defoliators.)

**Notodontidæ.**

*Phalera bucephala* Linnæus; Europe. (See Forest.)

**Tortricidæ.**

*Notocelia roborana* Treitschke; Europe. (See Gooseberry.)

**Pyralidæ.**

**Pionea ferrugalis* Hübner; Europe, Asia, North America. (See Cabbage.)

### HYMENOPTERA.

**Cephididæ.**

*Janus luteipes* Lep., sawfly, boring in stems; Europe.

**Argidæ.**

*Arge rosæ* Linn., sawfly feeds on foliage; Europe.

### LITERATURE.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.

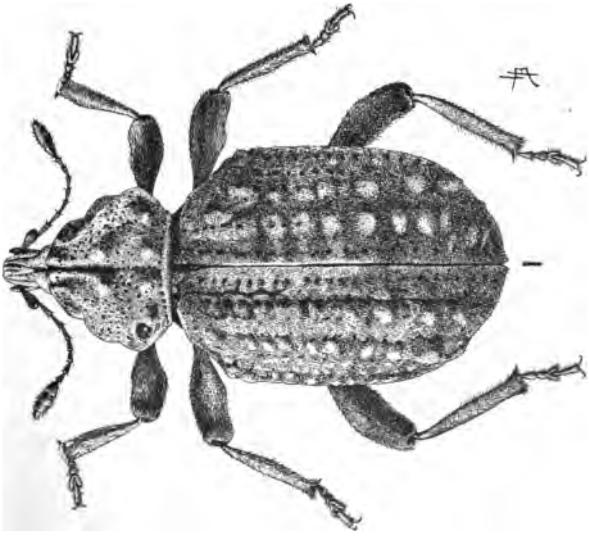
## ROYAL PALM.

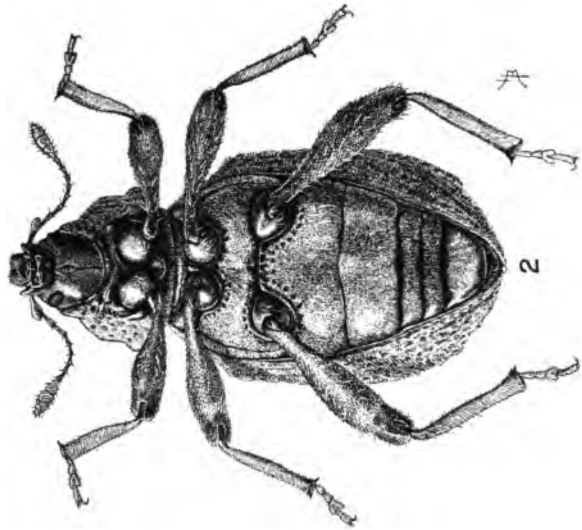
(*Oreodoxa regia*. Family Palmaceæ.)

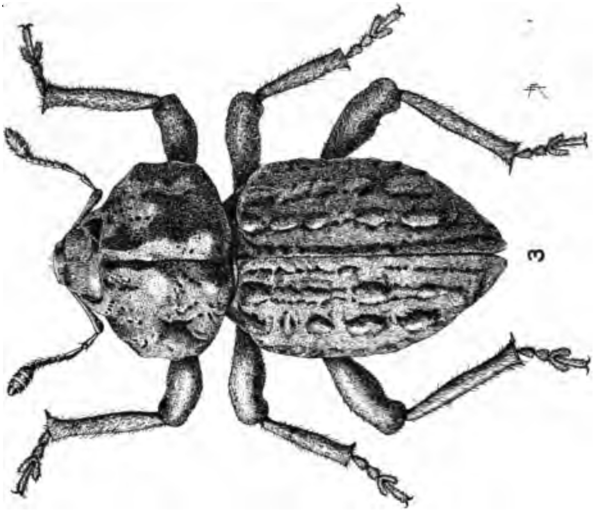
An American palm of magnificent growth. (See Palms.)

## RUBBER.

See Balota gutta percha; Fig (*Ficus* spp.); Ceara rubber; Panama rubber; Para rubber; Silk rubber; West African rubber.

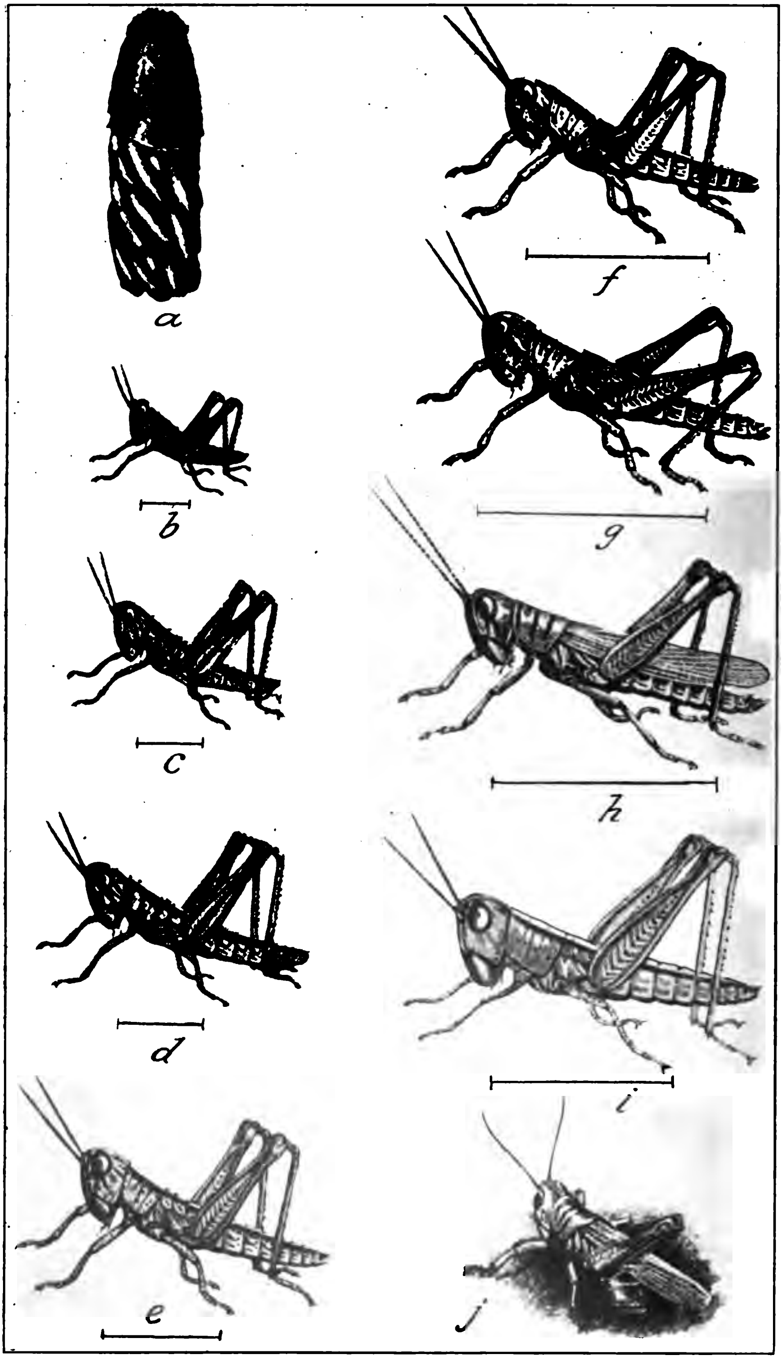

1


2


3

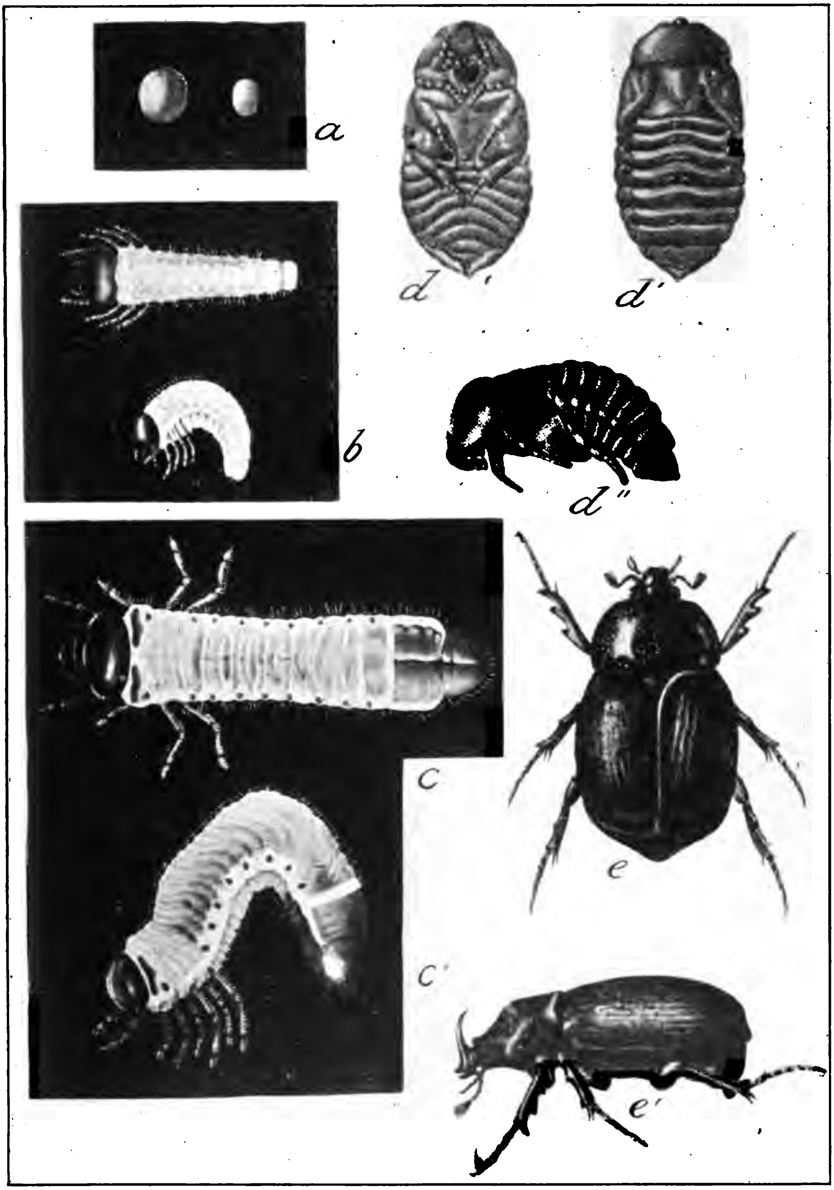
POTATO WEEVILS.

FIGS. 1, 2 *Premnotrypes solani.* FIG. 3, *Trypopremnon latithorax.* Pierce.)



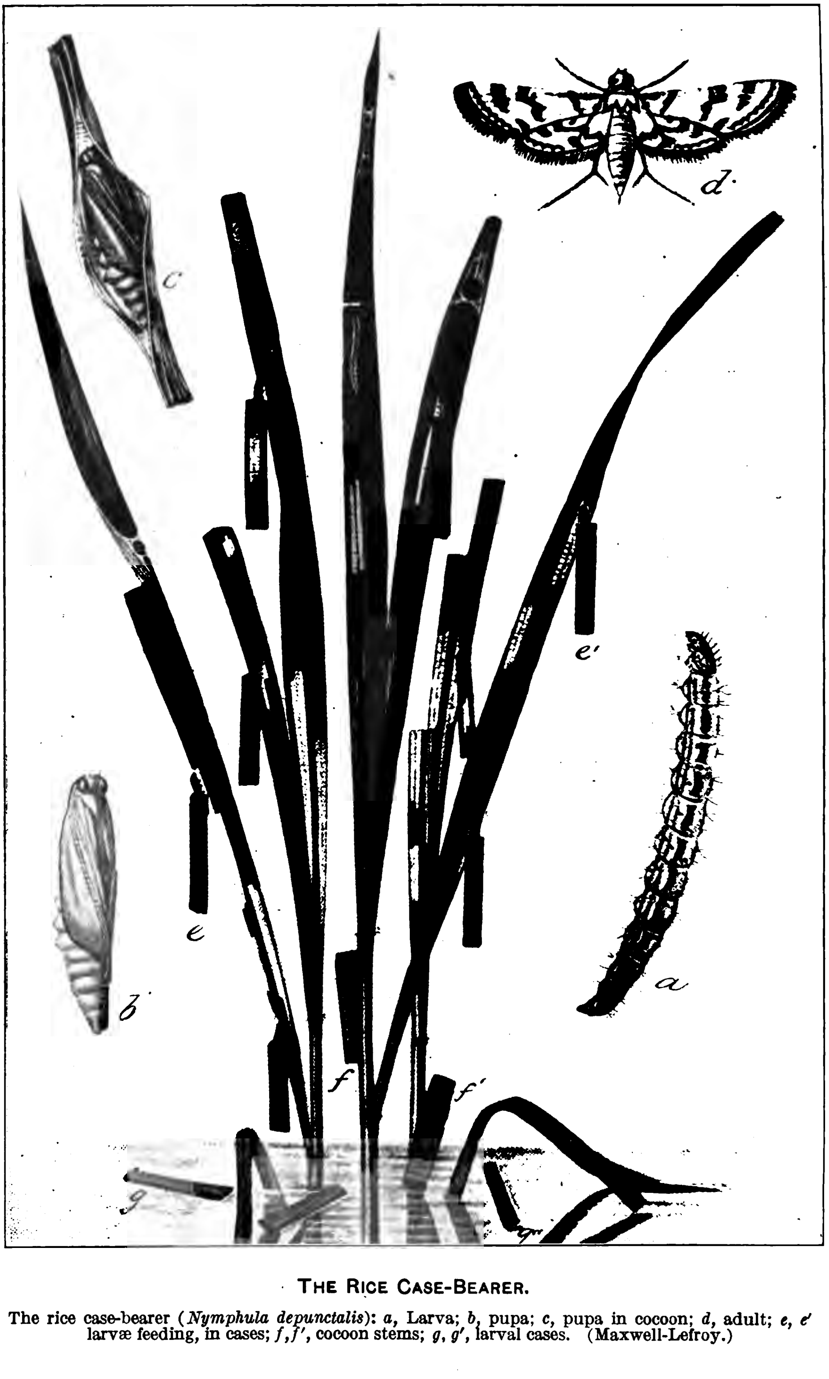
A DESTRUCTIVE RICE GRASSHOPPER.

The rice grasshopper (*Hieroglyphus banian*): *a*, Eggs; *b-g*, immature stages; *h*, adults; *j*, female laying eggs. (Maxwell-Lefroy.)



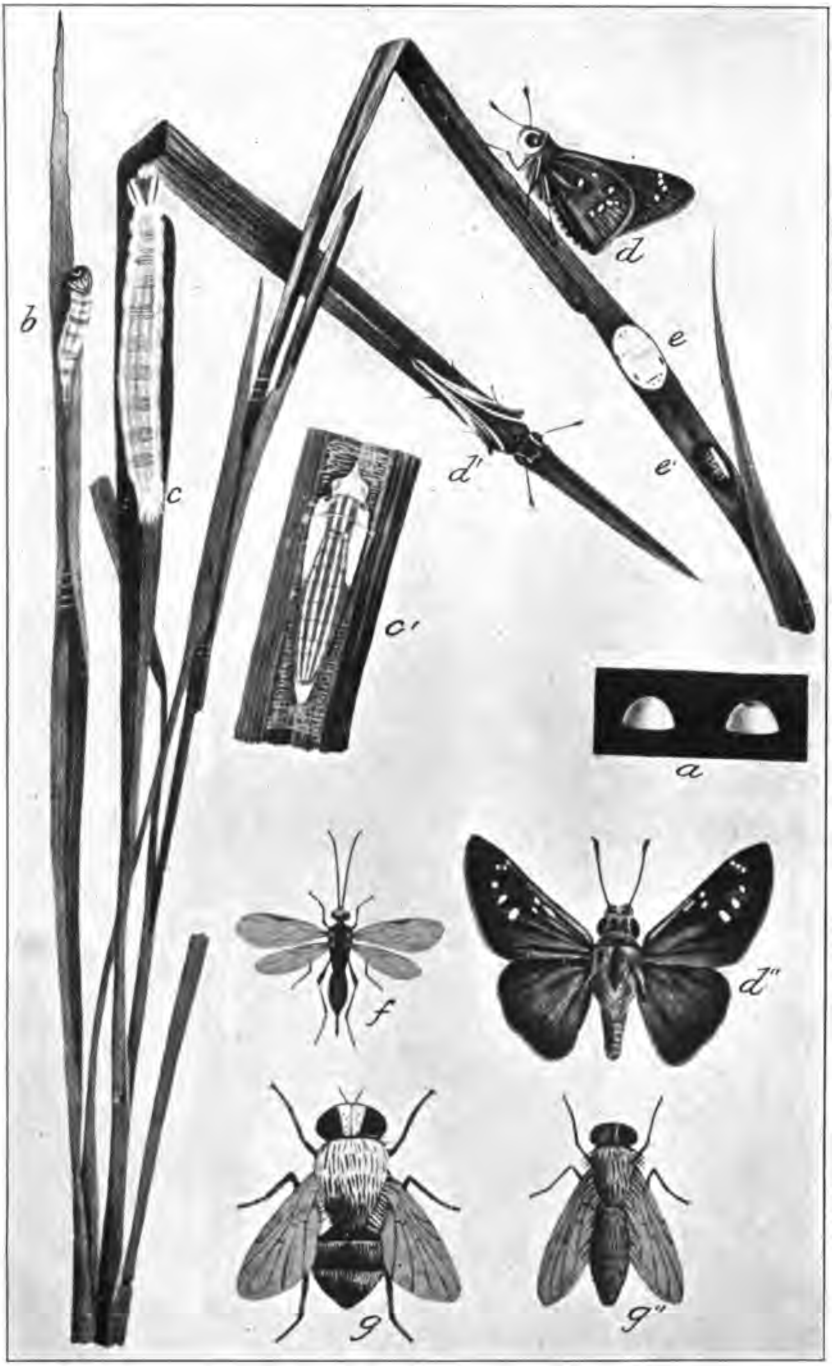
THE RICE ROOT GRUB.

Rice root grub (*Phyllognathus dionysius*): *a*, Eggs; *b, c, c'*, larvæ; *d, d', d''* ,pupæ; *e, e'*, adults. (Maxwell-Lefroy.)



THE RICE CASE-BEARER.

The rice case-bearer (*Nymphula depunctalis*): *a*, Larva; *b*, pupa; *c*, pupa in cocoon; *d*, adult; *e*, *e'* larvæ feeding, in cases; *f*, *f'*, cocoon stems; *g*, *g'*, larval cases. (Maxwell-Lefroy.)



THE RICE SKIPPER.

The rice skipper (*Parnara mathias*): *a*, Eggs; *b*, larva webbing leaf; *c*, full grown larva; *c'*, pupa; *d*, *d'*, *d''*, adults; *e*, *e'*, puparia of Tachinid flies; *f*, Ichneumonid parasite; *g*, *g''*, Tachinid parasite. (Maxwell-Lefroy.)

## RUTABAGA.

See Turnip.

## RYE.

(*Secale cereale* Linnæus. Family Gramineæ.)

This species as well as its near relatives is cultivated in Europe and Asia. For full treatment of its insect pests, see Grains and grasses.

## SAGO PALM.

(*Cycas revoluta*. Family Cycadaceæ.)

A palm-like plant of the Orient, much used in this country at funerals. (See Palms.)

## SAL.

(*Shorea* spp. Family Dipterocarpaceæ.)

Valuable timber trees of India.

### IMPORTANT SAL INSECTS.

#### COLEOPTERA.

**Scarabæidæ.**

*Serica assamensis* Brenske; India; adults defoliate and larvæ attack the roots of *Shorea robusta*.
*Lepidiota bimaculata* Saunders; India; adults feed on foliage of *Shorea robusta*.
*Phyllophaga problematica* Brenske (*Lachnosterna*), and *P. clypealis* Brenske; India; adults defoliate and larvæ attack the roots of *Shorea robusta*.
*Heteroplia varians* Olivier; India; breeds at roots of *Shorea robusta*.

**Cucujidæ.**

*Læmophlœus testaceus* Fabricius; India; breeds under the bark of felled trees of *Shorea robusta*.

**Bostrychidæ.**

*Schistoceros anobioides* Waterhouse; India; bores in trees of *Shorea robusta*.
*Heterobostrychus pileatus* Lesne, and *H. æqualis* Waterhouse; India; bore in timber of *Shorea robusta*.
*Sinoxylon crassum* Lesne; India; a serious borer in the wood *Shorea robusta*.
*Sinoxylon anale* Lesne; India; bores in *Shorea robusta*.

**Buprestidæ.**

*Acmæodera stictipennis* Laporte et Gory; India; bores in *Shorea robusta*.
*Chysobothris sexnotata* Gory; India; bores in the bark, bast, and sapwood of branches of *Shorea robusta*.
*Psiloptera viridans* Kerremans; India; bores in *Shorea robusta*.

**Elateridæ.**

*Alaus sculptus* Westwood; India; bores in logs of *Shorea robusta*.

**Tenebrionidæ.**

*Setenis lævis* Fairmaire, and *S. semivalga* Blair; India; bore in *Shorea robusta*.

**Cerambycidæ.**

*Acanthophorus serraticornis* Olivier; India; tunnels bast and sapwood of *Shorea robusta*.
*Cœlosterna scabrata* Fabricius; India; bores in sapwood of *Shorea robusta*.
*Plocæderus obesus* Gahan; India; bores in *Shorea robusta*.
*Æolesthes holosericea* Fabricius; India; bores in *Shorea robusta*.
*Dialeges pauper* Pascoe; India; bores in bast and sapwood felled and sickly trees of *Shorea robusta*.
*Hypoeschrus indicus* Gahan; India; bores in sapwood of *Shorea robusta*.
*Hoplocerambyx spinicornis* Newman; India; bores in wood of sickly or felled trees of *Shorea robusta*.
*Xylotrechus smei* Lap. et Gory; India; bores in *Shorea robusta*.

**Cossonidæ.**

*Conarthrus jansoni* Wollaston; India; bores in timber of *Shorea robusta*.
*Himatium asperum* Marshall; India; bores in *Shorea robusta*.

**Ipidæ.**

*Sphærotrypes assamensis* Stebbing, *S. globulus* Blandford, *S. siwalikensis* Stebbing, *Coccotrypes integer* Eichhoff, and *Dryocœtes minor* Stebbing; India; make galleries in wood and bark of *Shorea robusta*.
*Xyleborus fallax* Eichhoff, *X. perforans* Wollaston, *X. bengalensis* Stebbing, *X. major* Stebbing, *X. schlichii* Stebbing; India; bore in *Shorea robusta*.
*Xyleborus andrewesi* Blandford; India; bores in *Shorea talura*.

**Platypodidæ.**
*Crossotarsus saundersi* Chapuis; India; bores in *Shorea robusta.*
*Platypus curtus* Chapuis; India; bores in *Shorea robusta.*
*Platypus taluræ* Stebbing; India; bores in *Shorea talura.*
*Diapus furtivus* Sampson, *D. quinquespinatus* Chapuis, and *D. mirus* Sampson; India; bores in *shorea robusta.*

LEPIDOPTERA.

**Geometridæ.**
*Boarmia selanaria*; India; feeds on young growth, leaves, and flowers.

**Lasiocampidæ.**
*Suana concolor;* India; defoliator.
*Trabala vishnu*; India; defoliator.
*Dasychira horsfeldi*; India; defoliator.
*Leucoma diaphana:* India; defoliator.

**Lymantriidæ.**
*Lymantria grandis, L. lipcha,* and *L. brittata*; India; defoliators.

LITERATURE.

Stebbing, E. P. Indian Forest Insects, Coleoptera, 1914.
Stebbing, E. P. A Manual of Forest Zoology for India, 1908.

## SAPODILLA.

(*Sideroxylon* [*Achras*] *sapota.* Family Sapotaceæ.)

A fruit-bearing tree of the West Indies, central America, and northern South America, cultivated in southern Florida.

### IMPORTANT SAPODILLA INSECTS.

DIPTERA.

**Trypetidæ.**
*Ceratitis capitata* Wiedemann. (See Fruit.)
*Anastrepha ludens* Loew; Mexico. (See Fruit.)

## SILK COTTON.

(*Bombax malabaricum.* Family Malvaceæ.)

Tropical trees. The bark of some species produces commercial fiber.

### IMPORTANT SILK COTTON INSECTS

HEMIPTERA.

**Coccidæ.**
*Aspidoproctus giganteus* Newstead; Africa; *Ceiba bombaxi.*

COLEOPTERA.

**Bostrychidæ.**
*Heterobostrichus æqualis* Waterhouse; India; bores in the wood.

LEPIDOPTERA.

**Lymantriidæ.**
*Dasychira horsfeldi*; India; defoliator.

**Noctuidæ.**
*Mudaria cornifrons*; India; breeds in the pods.

LITERATURE.

Stebbing, E. P. Indian Forest Insects, Coleoptera, 1914.
Stebbing, E. P. Manual of Forest Zoology for India, 1908.

## SILKY OAK.

(*Grevillea robusta.* Family Proteaceæ.)

A valuable lawn tree with fine fern-leaved foliage, indigenous to Australia, but now cultivated in Florida and California.

### IMPORTANT SILKY OAK INSECTS.

**Æsiotes notabilis** Pascoe.

(Silky Oak Weevil Borer. Curculionidæ; Coleoptera.)

*Hosts*: Silky oak (*Grevillea robusta*), and kauri (*Agathis australis*).

*Injury:* Bores in wood and is easily transported in logs.

*Description:* A beautiful grayish weevil about 0.75 inch long, with brown and pinkish markings, humeri and apical declivities of elytra acute angulate or toothed, thorax and elytra tuberculate.

*Distribution:* Queensland, Victoria.

French, C. Handbook of the Destructive Insects of Victoria, pt. 5, pp. 106–108, pl. 119.

**Xenocnema spinipes** (Wallach) **australiæ** Lea.

(Spined Log Beetle. Cossonidæ, Coleoptera.)

*Hosts: Grevillea robusta* and *Agathis australis* (*Dammara*).

*Injury:* Riddles the wood of logs.

*Description:* A small brownish black elongate beetle. Found in large numbers under the bark and when the bark is removed they bore rapidly into the wood.

*Distribution:* Queensland, introduced into Victoria.

French, C. Handbook of the Destructive Insects of Victoria, 1911, pt. 5, pp. 126–128, pl. 124.

## SILK RUBBER; IRE.

(*Funtumia elastica* [*Kickxia*]. Family Apocynaceæ.)

### IMPORTANT SILK RUBBER INSECTS.

(Silk Rubber Longicorns. Cerambycidæ; Lamiinæ; Coleoptera.)

*Species: Acridocephala bistriata* Chevrolat; East and West Africa; *Funtumia elastica. Moecha adusta* Har.; West and East Africa; cacao, *Funtumia. Phryneta hecphora* Thoms.; Kamerun, East Africa; *Funtumia elastica. Phryneta cœca* Chevrolat; Kamerun; *Funtumia elastica.*

*Injury:* Bore in the wood.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 501, 502.

## SISSU.

(*Dalbergia sissoo*. Family Leguminosæ.)

A tree of India, furnishing a very desirable timber. It is cultivated in California.

### IMPORTANT SISSU INSECT.

LEPIDOPTERA.

**Noctuidæ.**

*Plecoptera reflexa* Guénée; India; defoliator.

## SORGHUM; KAFIR; DURRA; BROOM CORN.

(*Holcus sorghum* Linnæus. Family Gramineæ.)

Owing to the large number of useful varieties of this species throughout the world there is more or less commerce in the seed for propagation purposes at least. The dangers of importing injurious insects would consist mainly in the shipments of seed, although it is conceivable that boring insects might be introduced in brooms.

### IMPORTANT SORGHUM INSECTS.

LEPIDOPTERA.

**Pyralidæ.**

*Chilo simplex* Butler; India, Formosa. (See Sugar cane.)
*Chilo auricilia* Dudgeon; India. (See Rice.)

**Noctuidæ.**

*Sesamia cretica* Led.; Sudan; attacks durra. (See Sugar cane.)

## SOY BEAN.

(*Glycine hispida* Maxim. Family Leguminosæ.)

The soy bean was introduced into this country from the Orient. Care should be taken to see that seed pests are not introduced.

### AN IMPORTANT SOY-BEAN PEST.

**Laspeyresia glycinivorella** Matsumura (**Grapholitha**).

(Soy Bean Moth. Tortricidæ; Lepidoptera.)

*Host:* Soy bean.
*Injury:* Breeds in the pods; very injurious.
*Description and biology:* Similar to that of *L. nebritana* on peas.
*Distribution:* Japan.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 284.

## SPINACH.

(*Spinacia oleracea.* Family Chenopodiaceæ.)

An annual herb originating in Asia, now much cultivated for its edible foliage.

### AN IMPORTANT SPINACH INSECT.

DIPTERA.

**Anthomyidæ.**

* *Chortophila* (*Pegomya*) *hyoscyami* Panzer (spinach leafminer). (See Beets.)

## SPRUCE.

(*Abies* spp., *Picea* spp. Family Pinaceæ.)

Ornamental evergreen trees of the cold and temperate zones of the northern hemisphere, highly valued for shade, parking, wind breaks, and hedges, and valuable for timber. For convenience the insect pests are arranged under Conifers.

## STRAWBERRY.

(*Fragaria* spp. Family Rosaceæ.)

Low vines bearing delicious fruit, cultivated in Europe, and America especially.

### IMPORTANT STRAWBERRY INSECTS.

HEMIPTERA.

**Aphididæ.**

*Macrosiphum fragariæ* Koch; Europe; sucks juices.
*Macrosiphum fragariellum* Theobald; Europe.
*Macrosiphum rogersii* Theobald; England.

**Pentatomidæ.**

*Dindymus versicolor;* Australia; injurious.

COLEOPTERA.

**Carabidæ.**

*Harpalus ruficornis* Fabricius; Europe; attacks fruit.
*Pterostichus vulgaris* Linnæus; Europe; a wingless beetle, attacks fruit and also feeds on angleworms.

**Chrysomelidæ.**

*Galerucella tenella* Linnæus; leaf beetle; Europe; sometimes causes serious damage, larvæ and adults feed on leaves.

**Brachyrhinidæ.**

*Brachyrhinus tenebricosus* Herbst; Europe; larva feeds at roots, adults destroy buds and leaves. Several species of this genus have been introduced into the United States.

*Brachyrhinus picipes* Fabricius; pitchy-legged weevil; Europe; injures strawberry, raspberry, pea, turnip, kale, ferns, potted plants.

**Curculionidæ.**

*Anthonomus rubi* Herbst; Europe; larva attacks roots and runners, and adults destroy blossoms, buds and leaves.

*Rhinaria perdix* Pascoe; Australia.

### LEPIDOPTERA.

**Psychidæ.**

*Psyche viciella* Schiffermiller; Europe.

### LITERATURE.

Ormerod, E. A. Injurious Insects during 1897, pp. 111–112, 1898.
Ormerod, E. A. 16th Rept., Injurious Insects, pp. 124–126.
Curtis, John. Farm Insects, p. 383.

## SUGAR BEET.

(See Beet.)

## SUGAR CANE.

(*Saccharum officinarum* Linnæus. Family Gramineæ.)

Sugar cane is an important product of the Southern States, Hawaii, Porto Rico, and the Philippines. It is grown in many parts of the world. Owing, however, to the great danger of transporting insect enemies in the seed cane, its importation into the United States, except through the Department of Agriculture, has been forbidden. There is still a great possibility of the spread of its enemies from outside into the islands. Some very important cane insects also attack corn. The sugar cane is host to a multitude of insects which feed on its foliage, suck its juices, or bore in its stems or roots. Many of these insects are not very likely to be imported, but in view of such a possibility are briefly mentioned.

### A. SUGAR-CANE INSECTS LIKELY TO BE IMPORTED.

#### **Tetranychus exsiccator** Zehntner.

(Sugar-Cane Red Spider. Tetranychidæ; Acarina.)

*Host:* Sugar cane.

*Injury:* Sucks juices from the plant.

*Description and biology:* A tiny red mite similar in structure and habits to our common red spider, *Tetranychus bimaculatus*.

*Distribution:* Java.

Van Deventer, W. Handboek voor de Suikerriet-cultuur, Java, 1906, vol. 2, pp. 282–287, pl. 39.

#### **Tomaspis varia** Fabricius; **Tomaspis postica** Walker; **Tomaspis lepidior** Font.

(Sugar-Cane Frog Hoppers. Cercopidæ; Hemiptera.)

*Hosts:* Sugar cane, corn, grasses.

*Injury:* *Tomaspis varia* is a serious pest in Trinidad; damage called "blight" consists of withering of leaves and stunting of stem.

*Description and biology:* Adult *Tomaspis varia*, leafhopper 6–9 mm. long, with broad front wings; head and prothorax greenish, front wings brown with two yellow bands; undersides dark with sutures pinkish. The adults are not active in the daytime. They fly or hop when disturbed. *Nymphal* stages whitish with pink tinge;

completely covered by spittle within which they suck on the juices of the plant. *Eggs* elongate, oval, laid separately in incisions in dead or withering cane leaves. The other two species are similar to *T. varia*. (See plate XLII.)

*Distribution:* *T. varia*, Trinidad; *T. postica*, Mexico; *T. lepidior*, Panama.

URICH, F. W. Board of Agriculture, Trinidad and Tobago. Cir. 9, 1913, 45 pp., 9 pls., 7 text figs.

### Perkinsiella saccharicida Kirkaldy.

(Sugar-Cane Leafhopper. Fulgoridæ; Hemiptera.)

*Host:* Sugar cane.

*Injury:* Very serious drain on the vitality of the plant due to sucking of the juices. Liable to transportation on seed cane.

*Description and biology:* A small yellowish leaf hopper differing in the various stages mainly in the development of the wing pads. Eggs laid in slits in the epidermis of the leaves and stalks of cane. The insect in all stages sucks the juices of the plant. (See plate XLIII.)

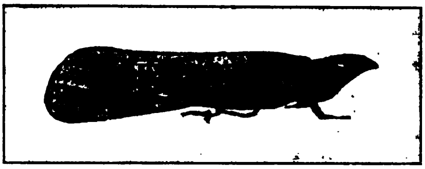


FIG. 94.—West Indian Cane Fly (*Stenocranus saccharivora*): Adult. (Ballou.)

*Distribution:* Hawaii, Australia. A large number of this species were captured in quarantine in shipments received at Washington from Hawaii.

VAN DINE, D. L. Hawaii Agric. Exp. Sta., Bul. 5, 1904, 29 pp., 8 figs.

### Stenocranus saccharivora Westwood.

(West Indian Cane Fly. Fulgoridæ; Hemiptera.)

*Host:* Sugar cane.

*Injury:* Very serious drain on vitality of plant due to sucking juices. Liable to transportation on seed cane.

*Description and biology:* A little yellow leafhopper differing but little in the various stages. It is not often a serious pest but at times does much damage. (See text fig. 94.)

*Distribution:* West Indies.

BASSIÈRES, EUGENE. La Sucrerie Indigène et Coloniale, Paris, 1912, vol. 79, pp. 27–32.

### Entochira lateralis Boheman. (Holaniara picescens Fairmaire).

(The Bibitkever. Tenebrionidæ; Coleoptera.)

*Hosts:* Sugar cane, tobacco.

*Injury:* Bores in the stalks, causing much damage. It can easily be transported in seed cane.

*Description and biology:* *Adult* beetle about 6 mm. long, black, with a brown metallic luster on the elytra. *Pupa* white, oval, acute at apex with many spiny tubercles on sides of abdomen. *Larva* an elongate brown wireworm with pointed apex, 10–11 mm. long. Bores in the stalks of cane near the nodes, and also bores in tobacco stems. *Eggs* less than 1 mm. long, oval, almost spherical.

*Distribution:* Java.

VAN DEVENTER, W. Handboek voor de Suikerriet-cultuur, Java, 1906, vol. 2, pp. 53–58, pl. 7.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 494.

**Apogonia destructor** Ritsema Bos.

(Javan Sugar-Cane Grub Beetle. Scarabæidæ; Coleoptera.)

*Hosts:* Sugar cane, grasses, and various plants.

*Injury:* Destructive in Java. Attacks the roots.

*Description and biology: Adult* about 0.5 inch long, greenish black, of the general form of a June beetle. *Pupa* white, broad in front, tapering behind, with all appendages beneath. *Larva* white, usually in a curved position, with large yellow head and long legs. Lives at roots of plants, causing much damage.

*Distribution:* Java.

Van Deventer, W. Handboek voor de Suikerriet-cultuur Java, 1906, vol. 2, pp. 282–287, plate 4.

**Apogonia ritsemæ** Sharp.

(Javan Sugar-Cane Grub Beetle. Scarabæidæ; Coleoptera.)

*Hosts:* Sugar cane, and other plants.

*Injury:* Destructive to the roots.

*Description and biology: Adult* reddish brown to blue-black. Somewhat smaller than *A. destructor*. Length 5–7 mm. Immature stages also similar. The larvæ are very destructive to the roots.

*Distribution:* Java.

Van Deventer, W. Handboek voor de Suikerriet-cultuur, Java, 1906, pp. 32, 33, pl. 5.

**Phytalus smithi** Arrow.

(The Brown Hard-Back Beetle. Scarabæidæ; Coleoptera.)

*Hosts:* Sugar cane.

*Injury:* Larva trims the small roots and is liable to transportation in the soil around cane plants.

*Description and biology: Adult* beetle tawny red of the shape and appearance of a June beetle, 14–18 mm. long. *Pupation* occurs in a cell in the ground. *Larva* a white grub, usually curved, with large brownish head, and long legs; bores in the sugar-cane stumps. *Eggs* laid in the soil.

*Distribution:* Mauritius, Barbados, Trinidad. Has been distributed in cane shipments.

Arrow, G. J. Annals and Mag. Nat. Hist., ser. 8, vol. 9, 1912, pp. 455–459.

**Aphanistichus consanguineus** Ritsema Bos.

(The Flat-Headed Leaf-Miner Beetle. Buprestidæ; Coleoptera.)

*Host:* Sugar cane.

*Injury:* Mines the leaves.

*Description and biology: Adult* beetle, 3.5 mm. long, black, head and prothorax with a bronzy tint. *Pupa* 3–5 mm. long, orange color, elongate elliptical, with all appendages beneath. *Larva* when full grown about 6 mm. long, orange colored, elongate, flattened, with sides crenulate. *Eggs* laid singly in the leaf.

*Distribution:* Java.

Van Deventer, W. Handboek voor de Suikerriet-cultuur, Java, 1906, vol. 2, pp. 46–53, pl. 6.

**Hispa wakkeri** Zehntner.

(Sugar-Cane Hispid Miner. Chrysomelidæ; Coleoptera.)

*Hosts:* Sugar cane.

*Injury:* Mines the leaves of sugar cane.

*Description and biology: Adult* beetle 5–6 mm. long, black, bristling with strong spines. *Pupa* cylindrical, yellow or red brown in color, 6-7 mm. long, formed in the leaf mine. *Larva* yellowish white, flattened, legless, with small brown head, brown prothoracic shields, and two apical teeth. Mines the leaves.

*Distribution:* Java.

Van Deventer, W. Handboek voor de Suikerriet-cultuur, Java, 1906, pp. 66–70, pl. 9.

### **Diaprepes abbreviatus** Linnæus (**spengleri** Linnæus).

(West Indian Sugar-Cane Root Borer. Brachyrhinidæ [Otiorhynchidæ]; Coleoptera.)

*Hosts:* Sugar cane, orange, guava, avocado, mango, rose, Indian corn, Guinea corn, sweet potatoes, Bahama grass (*Cynodon dactylon*), limes, and other plants.

*Injury:* The larva does serious injury to the roots and the adult to the foliage. Liable to transmission in seed-cane shipment.

*Description and biology: Adult* 8–18 mm. in length; variable in color from white to green and ochraceous, with from four to many denuded elytral striæ beak thick, tricarinate, antennæ elbowed. *Pupa* 19 mm. long, soft and white with a long thick beak. *Larva* long, white, curved, footless. *Eggs* oblong, oval, smooth, white, laid in clusters on leaves and glued between two leaf surfaces. The larvæ feed at the root system and tunnel the stalk of the plants above named.

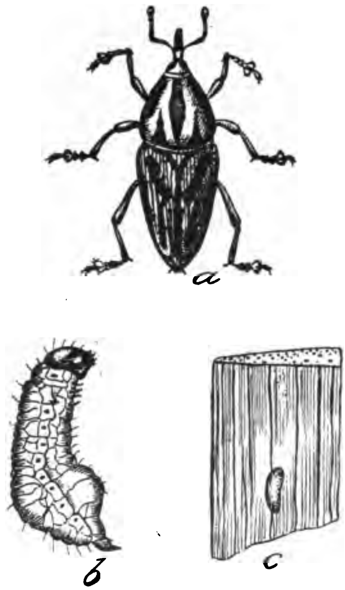


Fig. 95.—Sugar-cane borer (*Metamasius sericeus*): *a*, Adult; *b*, larva; *c*, injury. (Ballou.)

*Distribution:* Porto Rico to Barbados. (See plate xlviii.)

Pierce, W. D. On Some West Indian Sugar-Cane Root-Boring Weevils. Journ. Agr. Research, U. S. Dept. Agr., vol. 4, pp. 255–263, 1915 (Plates XXXV to XXXVIII).

### **Metamasius hemipterus** Linnæus.

(West Indian Sugar-Cane Borer. Calandridæ; Coleoptera.)

*Host:* Sugar cane.

*Injury:* Serious pest to the stalks of cane. Liable to importation in seed cane.

*Description and biology: Adult* weevil about half an inch long, brown with dark markings on the thorax and elytra. The head is prolonged into a long beak. *Pupa* white with appendages folded beneath. It is formed inside a cocoon of fiber. *Larva* pale yellow, with brownish head, legless, wrinkled in appearance with the hind part of the body swollen; bores downward in the cane stalk. *Eggs* laid singly beneath the rind of the stalk or in the leaf sheaths.

*Distribution:* West Indies, Trinidad.

Van Dine, D. L. Porto Rico Sugar Growers' Association, 1911, Year Book, pp. 55–56.

### **Metamasius sericeus** Olivier.

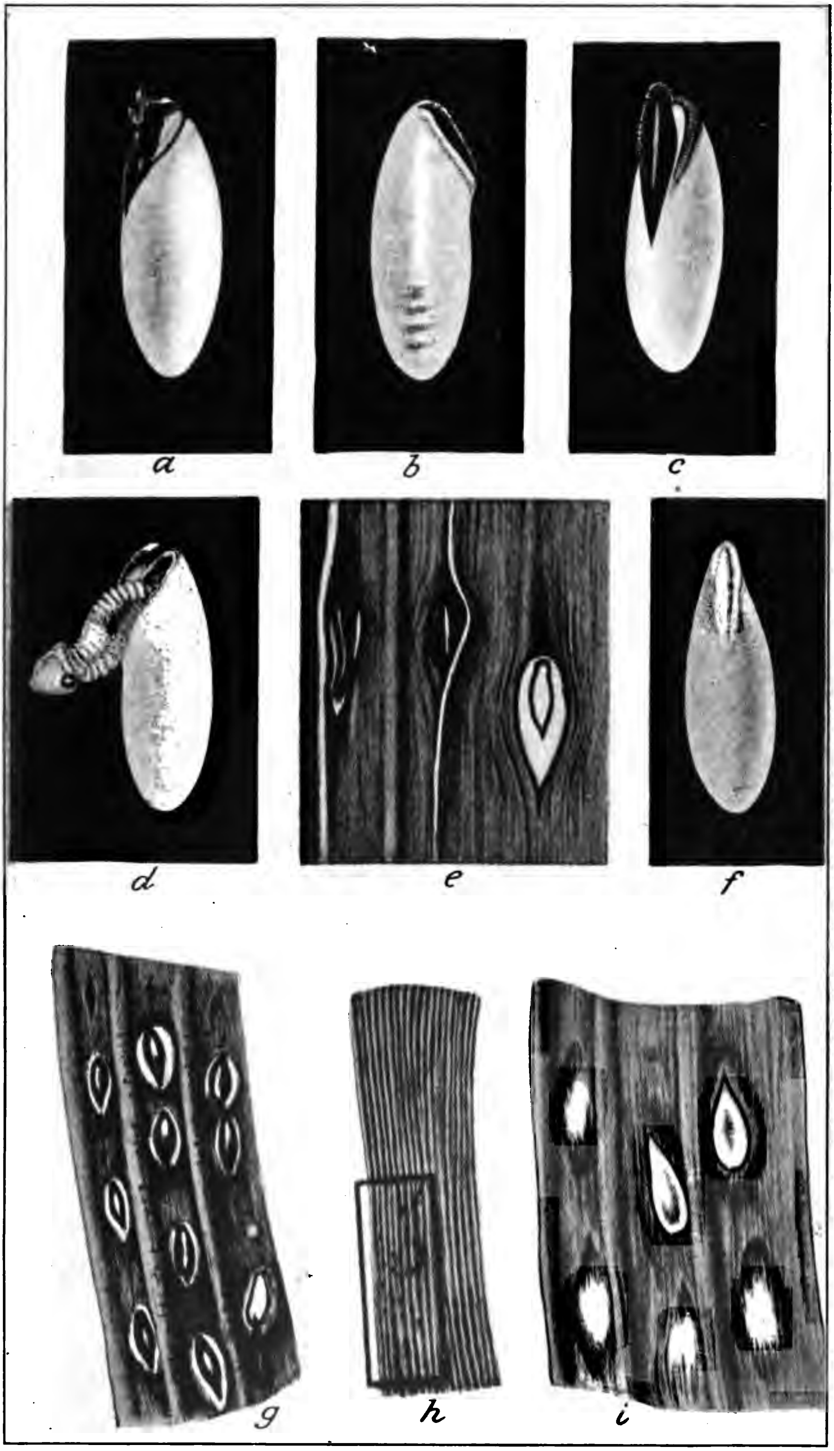
(Sugar-Cane Borer. Calandridæ; Coleoptera.)

*Host:* Sugar cane.

*Injury:* Serious pest to cane stalks. Liable to importation in seed cane.

*Description and biology:* Very similar in general appearance and habits to *Metamasius hemipterus* Linnaeus. (See text fig. 95.)

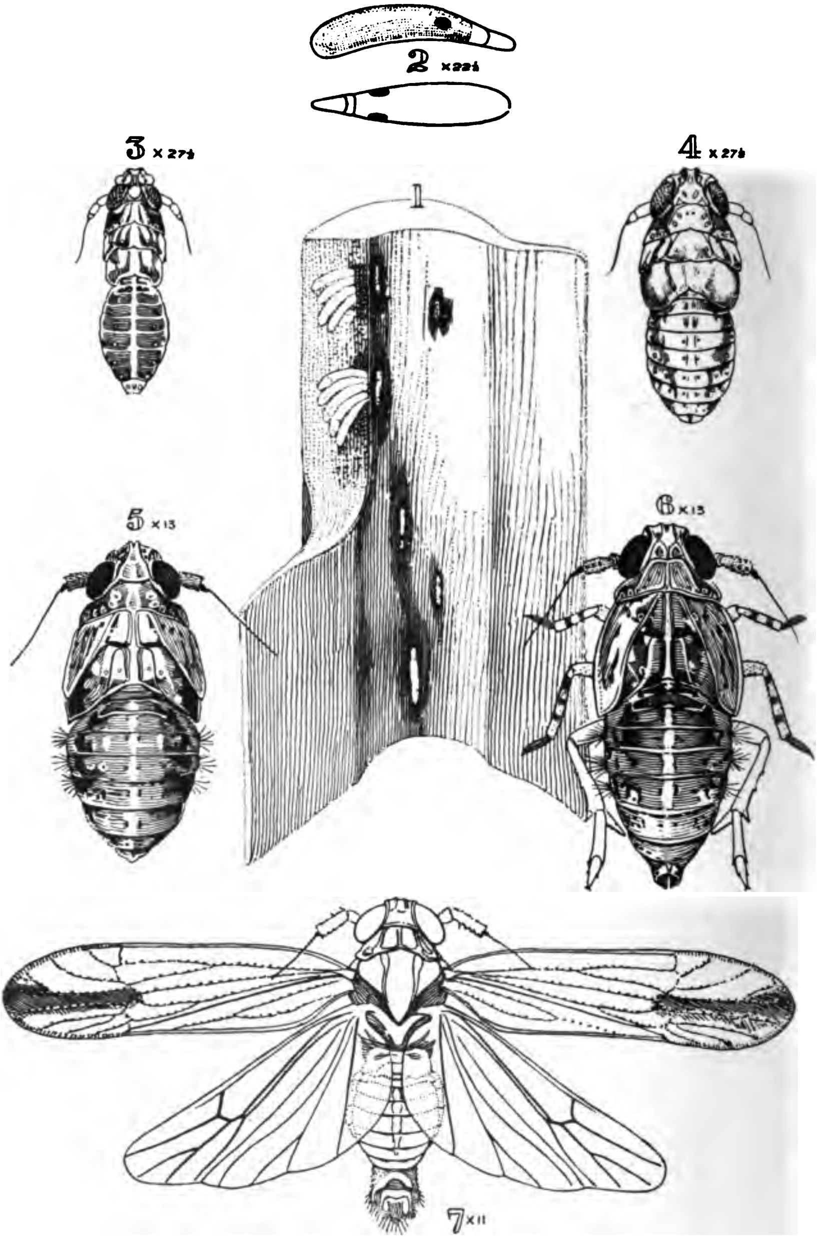
*Distribution:* West Indies.



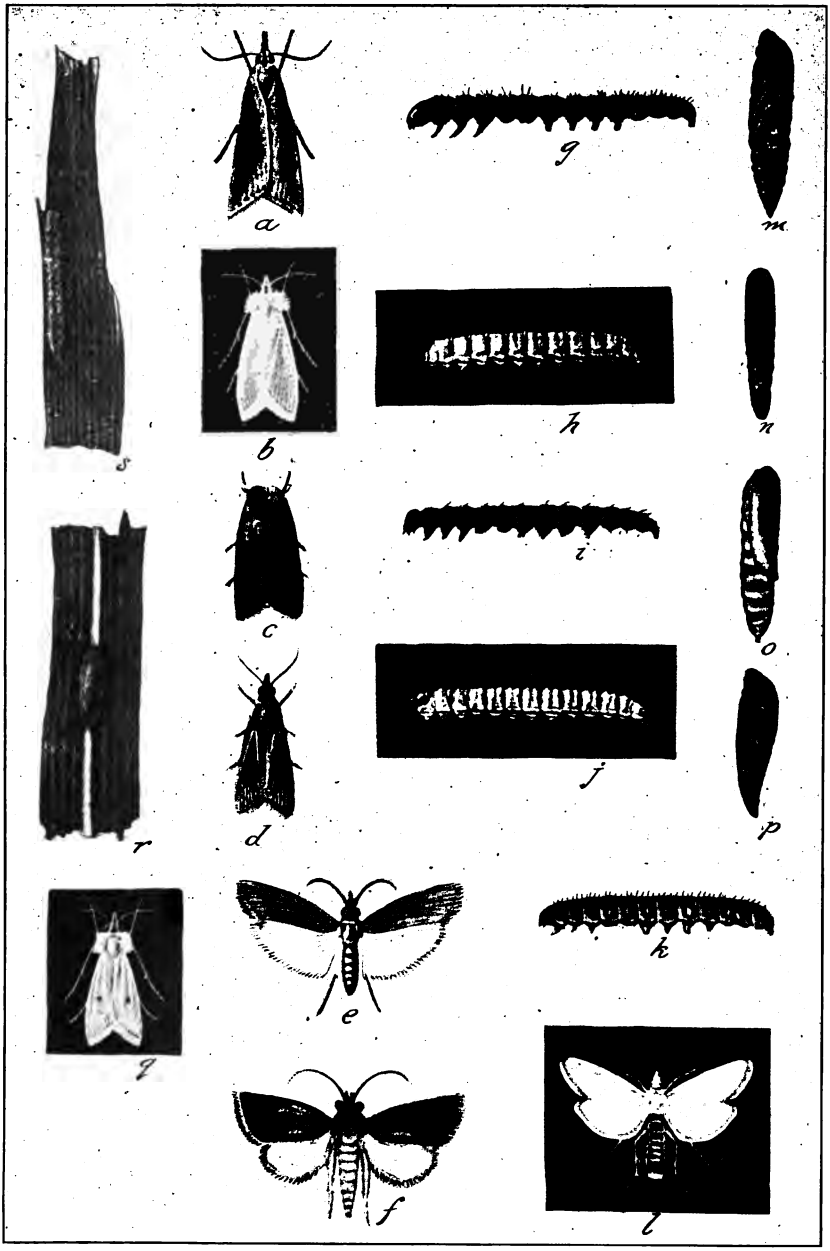
THE SUGAR-CANE FROGHOPPER.

The sugar-cane froghopper *Tomaspis varia*): Eggs, and egg punctures. (Urich.)

UNI

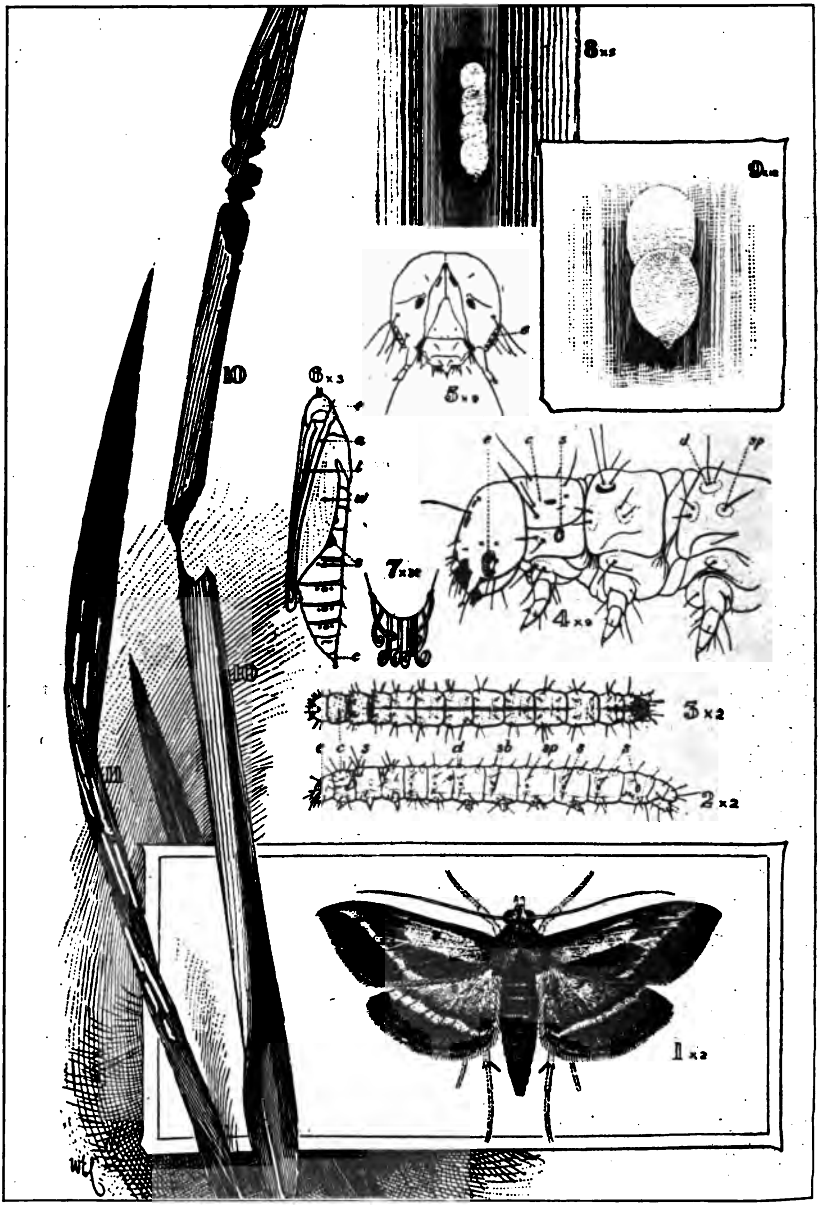


THE SUGAR-CANE LEAFHOPPER (PERKINSIELLA SACCHARICIDA). (KIRKALDY.)



## CANE BORERS.

Cane borers. Figs. *a, g, m, s.*—*Chilo simplex*: Eggs, larva, pupa, adult. Figs. *b, h, l, n, r.*—*Scirpophaga auriflua:* Egg, larva, pupa, adults. Fig. *q.*—*Scirpophaga monostigma:* Adult. Figs. *c. f, i, o.*—*Nonagria uniformis:* Larva, pupa, adults. Figs. *d, j, p.*—*Polyocha saccharella:* Larva, pupa, adult. Figs. *e, k.*—*Anerastia ablutella:* Larva, adult. (Maxwell-Lefroy.)



THE SUGAR-CANE LEAF-ROLLER.

The sugar-cane leaf-roller (*Omiodes accepta*): FIG. 1.—Adult. FIGS. 2, 3, 4, 5.—Larva. FIGS. 6, 7.—Pupa. FIGS. 8, 9.—Eggs. FIGS. 10, 11.—Injury. (Swezey.)

### **Rhabdocnemis obscurus** Boisduval.

(Hawaiian Sugar-Cane Borer. Calandridæ; Coleoptera,)

*Hosts:* Banana, sugar cane, coconut, sago palm, royal palm, wine palm (*Caryota urens*), papaya (*Carica papaya*).

*Injury:* Very injurious to the stalk. Liable to importation in seed cane.

*Description and biology: Adult* weevil reddish brown with darker brown markings, long beak, elbowed antennæ, over 0.5 inch long. *Pupa* white, in cocoon of fiber. *Larva* white, curved, legless. Bores in the stalks and roots. (See text fig. 96.)

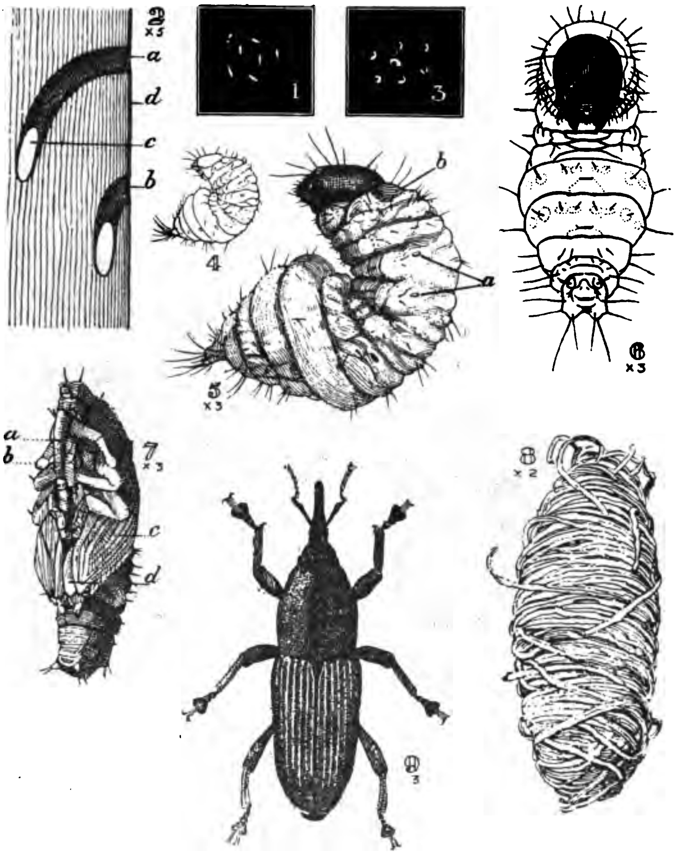


FIG. 96.—The Hawaiian sugar-cane borer (*Rhabdocnemis obscurus* [*Sphenophorus*]): *1*, Eggs, natural size. *2*, Eggs in situ, much enlarged: *a*, Section of egg passage with egg, *c*; *b*, egg placed unusually near the rind, *d*. *3*, Larvæ, just hatched and older, natural size. *4*, Full-grown larva, natural size. *5*, Larva, side view, enlarged: *a*, Spiracles; *b*, cervical shield. *6*, Larva, front view, enlarged. *7*, Pupa, enlarged : *a*, Rostrum or beak; *b*, antenna; *c*, elytron or wing cover; *d*, folded wing. *8*, Pupal case or cocoon, enlarged. *9*, Adult, enlarged. (Terry.)

*Distribution:* Hawaii, Jamaica, Barbados, St. Kitts, Antigua, St. Lucia, British Guiana, Fiji, New Guinea, New Ireland, Tahiti, Queensland, Malay Archipelago.

VAN DINE, D. L. U. S. Dept. Agr., Bul. 93, 1911, pp. 35–40. Figs. 4, 5.

**Xyleborus perforans** Wollaston.

(Sugar-Cane Ambrosia Beetle. Scolytidæ; Coleoptera.)

*Hosts:* Sugar cane, a polyphagous insect breeding in many kinds of wood.

*Injury:* Is very injurious to sugar cane in Java. As it bores in the stalks it can easily be transported in shipments of seed cane.

*Description and biology: Adult* weevils about 2 mm. long, cylindrical, without snout, the head completely concealed from above. *Pupa* white, about 2 mm. long with head and all appendages on the underside. *Larva* cylindrical, white, legless, with chitinized head. Bores in the pith of the stalk. *Eggs* elliptical. About 70 to 100 eggs are laid by the parent, each at the end of a separate chamber.

*Distribution:* Java, cosmopolitan in the tropics and subtropics.

Van Deventer, W. Handboek, voor de Suikerriet-cultuur, Java, 1906, **vol. 2,** pp. 60–66, pl. 8.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 573–574.

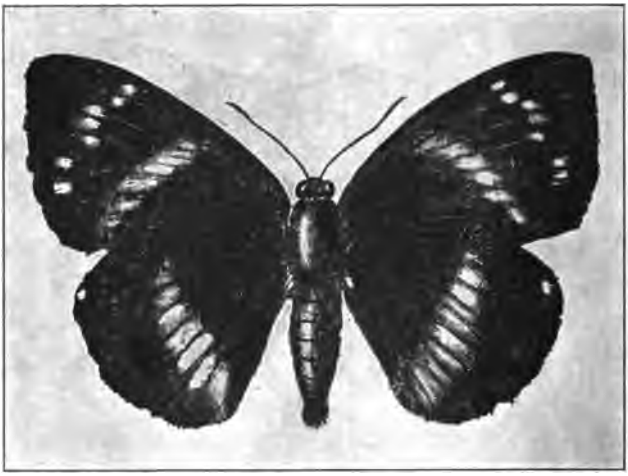


Fig. 97.—Cane-sucker moth (*Castnia licus*). (Ballou.)

**Castnia licus** Drury.

(Cane-Sucker Moth: Giant Sugar Cane Borer. Castniidæ; Lepidoptera.)

*Hosts:* Sugar cane, banana, coconut, orchids, and Bromeliaceæ.

*Injury:* Very serious borer in cane stalks. When cane is to be imported from sections where this species occurs great care should be used to eliminate trash. Only the tops should be shipped, and these should be carefully examined for eggs or larvæ at the base of the leaves.

*Description and biology: Moth* measuring over 3 inches in wing expanse, brown with a white band crossing each wing and a few yellow spots beyond. *Pupa* reddish brown, over an inch in length. *Larva* whitish, about 2 inches long, with reddish brown head. Bores in the stalks of its food plants. *Eggs* laid singly, pinkish, elongate, pointed at each end, ribbed, in cross section formed like a five-pointed star. Over 50 eggs are laid by each moth. (See text fig. 97.)

*Distribution:* British Guiana, Dutch Guiana, Trinidad, and other parts of northern South America.

Urich, F. W. The Cane Sucker. 2 pp., with colored plate.

Marlatt, C. L. Bureau of Entomology, U. S. Dept. Agr., Bul. 54, 1905, pp. 71-75, pl. 4.

### **Sesamia cretica** Led.

(Durra Stem Borer. Noctuidæ; Lepidoptera.)

*Host:* Sugar cane, corn, durra.

*Injury:* Very serious pest in Khartoum. Is liable to importation in seed cane.

*Description and biology: Adult*, a stout bodied, creamy colored moth, with wing expanse of about 30 mm.; hind wings silvery white; forewings creamy with faint brownish markings. *Pupa* 15–18 mm. long, chestnut colored. *Larva* 25–30 mm. long, varying from pinkish or yellowish to dead white; head brown, spiracles black. *Egg* white, 6 mm. in diameter. While this pest is more important as an enemy of durra and maize in Khartoum it is more likely to transportation in sugar cane.

*Distribution:* Khartoum, Sudan.

KING, H. H. Third Report Wellcome Research Laboratory Khartoum, 1904, pp 222–224; pl. 27, figs. 1, 3, 6, in color.

### **Diatræa** spp.

(Sugar-Cane Borer Moths. Pyralidæ; Lepidoptera.)

*Species:* **Diatræa saccharalis* Fabricius; Mexico, West Indies, United States. *D. striatalis* Sn.; West Indies, Java. *D. canella* Hampson; Trinidad, Grenada, Guiana. *D. lineolata* Walker; Trinidad, West Indies, Central America, South America.

*Hosts:* Sugar cane and grasses.

*Injury:* Very serious injury by boring in the stalk. Easy to transport in seed-cane shipments.

*Description and biology:* Gray moths with whitish-spotted larvæ. Pupate in the stalks in the larval tunnels. Eggs are laid in clusters. *Diatræa saccharalis* has been fully treated in American literature. The others behave in a similar manner.

BARBER, T. C. U. S. Dept. Agr., Bur. Ent., 1911, Circ. 139.

STUBBS, W. C., and MORGAN, H. A. Louisiana Exp. Sta., ser. 2, 1902, Bull. 70.

VAN DEVENTER, W. Handboek voor de Suikerrietcultuur, Java, 1906, pp. 131–139, pl. 20.

### **Chilo simplex** Butler.

(Sugar-Cane Moth Borer of India. Pyralidæ; Lepidoptera.)

*Hosts:* Sugar cane, corn, sorghum, rice, millet.

*Injury:* Very serious pest, boring in the stalks. It is liable to importation in seed cane.

*Description and biology: Moth* yellowish gray, the male a little smaller and darker. *Pupation* occurs in the larval tunnel. *Larva* about an inch long, with a dirty white body and black head, a dark patch behind head and two dark longitudinal lines on body. The small hairs of the body are set on black dots. The larva burrows in the stalks of cane, corn, sorghum, rice, and millet. *Eggs* laid in rows, side by side on the leaves. (See plate XLIV, figs. a, g, m, s.)

*Distribution:* India, Formosa.

MAXWELL-LEFROY, H. F. Moth Borer in Sugar Cane. Agr. Journ. India, vol. 1, pp. 97–115.

BASU, S. K., and DUTT, H. L. Crop Pest Handbook for Behar and Orissa. Calcutta Leaflet 56, pl. 38.

### **Omiodes accepta** Butler.

(Hawaiian Sugar-Cane Leafroller. Pyralidæ; Lepidoptera.)

*Hosts:* Sugar cane, grasses, sedges.

*Injury:* Feeds on the leaves, which it rolls for its protection. The damage is sometimes serious. Is liable to importation in seed cane.

*Description and biology: Adult,* brownish with white-lined veins and margins of segments; wings with two darker bands; antennæ long. Wing expanse 20–30 mm. *Pupa* 12–14 mm. long, light brown. *Larva* 27 mm. long, green with a few scattered hairs; head pale yellowish. The larva feeds on the leaf, folding it into a tube to protect itself while feeding, changing to a new leaf when it has eaten all it can. When disturbed it drops to the ground. *Eggs* laid in small clusters arranged in rows on the surface of leaves. (See plate XLV.)

*Distribution:* Hawaii, Peru.

SWEZEY, OTTO H. Hawaiian Sugar Planters' Assn., Bull. 5, pp. 6–10, pl. 1.

### **Polyocha saccharella** Dudgeon.

(Cane Root Borer. Pyralidæ; Lepidoptera.)

*Hosts:* Sugar cane.

*Injury:* Causes stunted growth and shriveling of plants by boring in stalks and roots.

*Description and biology: Moth* small, brown, with hind wings white. *Pupates* in stalk. *Larva* about 0.75 inch in length, of white color; bores in stalk and root; hibernates in root; before pupating it eats an opening in the stem and covers it with silk. (See plate XLIV, figs. *d, j, p.*)

*Distribution:* India.

BASU, S. K., and DUTT, H. L. Crop Pest Handbook for Behar and Orissa, Calcutta, Leaflet 58, pl. 38.

### **Ereunetis flavistriata** Walsingham.

(Sugar-Cane Bud Moth. Tineidæ; Lepidoptera.)

*Hosts:* Sugar cane, palms, banana, pineapple, *Pandanus.*

*Injury:* While this species mainly lives in the dead tissues of the above food plants, it breeds in cane stalks among the dry leaves, but often eats out the eyes or buds, thus destroying the propagating value of the cane. It may easily be transported in seed cane.

*Description and biology:* A small *moth,* measuring 14 mm. in wing expanse, head and thorax yellowish white, forewings yellowish white, with indistinct yellow streaks, hind wings shining pale golden yellow, becoming white at apex. *Pupa* 5 to 6 mm. long, pale yellowish brown. *Larva* 12 to 15 mm. long, whitish, head reddish brown, hairs on darker tubercles. The larva usually feeds in the dried leaf sheaths, but sometimes attacks the rind, giving entrance to fungi, and does the greatest damage by eating out the eyes.

*Distribution:* Hawaii.

SWEZEY, OTTO H. Hawaiian Sugar Planters' Association, bul. 6, pp. 9–12, pl. 2, figs. 1–6.

### **Laspeyresia schistaceana** Sn. **(Grapholitha).**

(Gray Borer of the Sugar Cane. Tortricidæ; Lepidoptera.)

*Hosts:* Sugar cane.

*Injury:* Very important in Java. Is liable to importation in seed cane.

*Description and biology: Moth* about 12 mm. long, grayish brown. *Pupa* reddish brown, 8–13 mm. long. *Larva* yellowish, with head and collar on prothorax as well as two apical segments chitinized reddish brown. Hairs sparse on brownish spots. The larva bores in stalks of the cane. *Eggs* oval; about 120 to 170 are laid in a row under the leaf or behind the sheath of the cane.

*Distribution:* Java.

VAN DEVENTER, W. Handboek voor de Suikerriet-cultuur, Java, 1906, vol. 2, pp. 142–150, pl. 21, text figs. 46–49.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 284.

## B. OTHER IMPORTANT SUGAR-CANE INSECTS.

### ORTHOPTERA.

**Acridiidæ and Locustidæ.**

*Oxya intricata* Stål of Formosa and Japan; *O. velox* Fabricius of China, Japan, India, and Islands o the Pacific Ocean; *O. annulicornis* Matsumura of Formosa; attack foliage.

*Epacromia tamulus* Fabricius and *Trilophidia annulata* Thunberg; Java; attack foliage.

*Racilia okinawensis* Matsumura of Formosa.

*Gelastorhinus esox* Burr of Japan and Formosa.

*Acridium succinctum* Linnæus and *A. flavicorne* Fabricius of Japan, China, India, Formosa, and the Malay Archipelago; *A. roseum* De Geer, *A. zehntneri* Krauss, *A. luteicorne* Serville, and *A. ærugினosum* Linnæus of Java.

*Pachytylus migratorioides* Reicharting, an especially serious pest in Formosa, Asia, Africa, and Australia; *Œdaleus infernalis* Saussure of Japan, China, Formosa, India, and Malaysia; *O. nigrofasciatus* Latreille of Asia, Europe, and Africa.

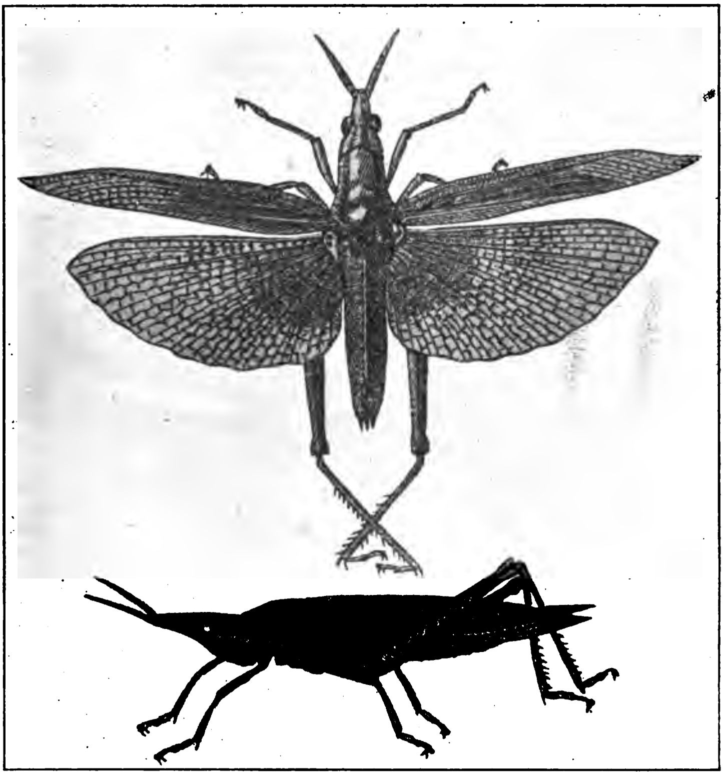


Fig. 98.—Cane grasshopper (*Atractomorpha crenulata*). (Maxwell-Lefroy.)

*Atractomorpha crenulata* Fabricius (See text, fig. 98) and *A. psittacina* De Haan of Java; *A. bedeli* Bolivar of Japan, China, and Formosa.

*Elimæa chloris* De Haan, *Mecopoda elongata* Linnæus; Java.

*Tryxalis nasuta* Linnæus of Formosa, Asia, Africa, and Europe; *Phlæoba infumata* Brun, of Formosa, China, and Malaysia; *Stenobothurus formosanus* Matsumura of Formosa; *Trilophidia annulata* Thunberg and *Epacromia tamulus* Fabricius of Asia and the islands of the Pacific; *Paratettix gracilis* Shiraki, *P. singularis* Shiraki, *Hedotettix arcuatus* Shiraki, and *Tettix formosanus* Shiraki of Formosa.

**Gryllidæ, Gryllotalpidæ.**

*Liogryllus bimaculatus* De Geer, L. *formosanus* Matsumurà, *Gryllus mitratus* Burmeister, *Tridactylus flavomaculatus* Matsumura, *Gryllotalpa africana* Pallas; *Œcanthus indicus* Saussure, *Anaxiphus pallidulus* Matsumura, and *Trigonidium haani* Saussure; Oriental Regions.

## HEMIPTERA.

**Coccidæ.**

Armored—
*Aspidiotus* (*Odonaspsis*) *secreta saccharicaulis* Zehntner; Java.
*Aspidiotus* (*Targionia*) *glomerata* Green; India.
*Aspidiotus* (*Targionia*) *sacchari* Cockerell; West Indies, Java, British Guiana.
*Chionaspis depressa* Zehntner; Java, India.
*Chionaspis madiunensis* Zehntner; Java.
*Chionaspis saccharifolii* Zehntner; Java.
*Chionaspis tegalensis* Zehntner; Java, Mauritius.

Unarmored—
*Aclerda japonica* Newstead; India.
*Asterolecanium bambusæ* Boisduval; Madeira.
*Icerya seychellarum* Westwood; Seychelles, Madeira, Formosa.
*Lecanium guerinii* Signoret; Mauritius.
*Lecanium krugeri* Zehntner; Java.
*Margarodes formicarum* Guild; Barbados.
*Pseudococcus boninsis* Kuwana; Japan.
*_Pseudococcus bromeliæ_ Bouché; Hawaii.
*Pseudococcus calceolariæ* Maskell; Hawaii, St. Croix, Porto Rico, Barbados. (See pl. XLVI.)
*Pseudococcus sacchari* Cockerell; Costa Rica, Hawaii, Porto Rico, Barbados, Cuba.
*Pseudococcus saccharifolii* Green; Hawaii.
*_Pseudococcus texensis_ Tinsley; Texas, Mauritius.
*Pulvinaria iceryi* Guérin; Mauritius, Formosa.
*Ripersia sacchari* Guénée; India.

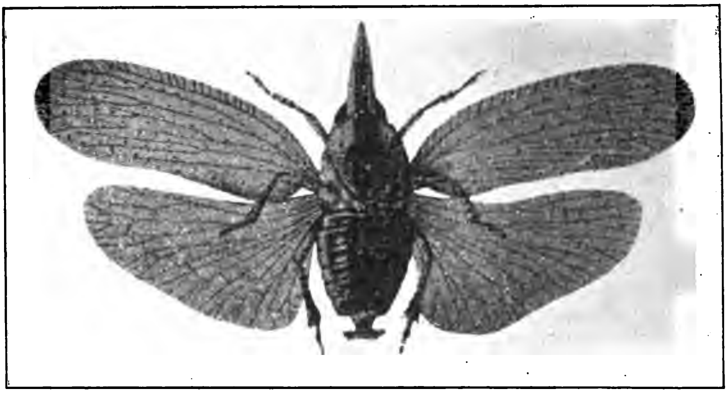


Fig. 99.—Cane leafhopper (*Pyrilla aberrans*).

**Jassoidea. Fulgoroidea.**

*Dictyophora sinica* Walker, *Anagnia splendens* Germar, *Ricania tæniata* Stål., *Diastrombus politus.* Uhler, *Phenice moesta* Westwood, *Nicertoides saccharivora* Matsumura, *Nisia atrovenosa* Lethierry, *Oliarus oryzæ* Matsumura, *Delphacodes vastatrix* Breddin, which is very injurious in Java; *Kirbya pagana* Melichar, *Tropidocephala brunneipennis* Signoret, *T. saccharivorella* Matsumura, *T. formosana* Matsumura, *Stenocranus sacchari* Matsumura, *Delphax propinqua* Fieber, *D. furcifera* Horvath, *D. graminicola* Matsumura, *D. fumosa* Matsumura, *Zygina circumscripta* Matsumura, *Z. maculifrons* Motschulsky, *Z. subrufa* Melichar, *Gnathodus viridis* Matsumura, *G. pallidulus* Matsumura, *Cicadula fasciifrons*, *C. 6-notata* Fallen, *Nirvana pallida* Melichar, *N. suturalis* Melichar, *Deltocephalus dorsalis* Motschulsky, *Nephotettix apicalis* Motschulsky, *Eucanthus semiglauca* Lethierry, *Tetigonia viridis* Linnæus, *T. albida* Walker, *T. ferruginea* Fabricius, *Strongylocephalus agrestis* Fallen, and *Ptyelus costalis* Walker; Formosa and oriental regions; *Pyrilla aberrans* Distant, India. (See text, fig. 99.) *Phenice maculosa* Westwood, *Dicranotropis vastatrix* Breddin, and *Eumetopina krugeri* Breddin; Java.

The leafhoppers of the genus *Perkinsiella* seem to be partial to sugar cane, sometimes attacking grasses. Aside from *P. saccharicida* Kirkaldy, treated above, the following species are recorded by Muir: *P. vitiensis* Kirkaldy, Fiji; *P. graminicola* Kirkaldy, Hawaii; *P. sinensis* Kirkaldy, Borneo; *P. pallidula* Muir, Borneo; *P. rattlei* Muir, British New Guinea; *P. bicoloris* Muir, British New Guinea; *P. variegata* Muir, British New Guinea; *P. papuensis* Muir, British New Guinea; *P. vastatrix* Breddin, Java, Borneo, British New Guinea; *P. lalokensis*, Muir, British New Guinea; *P. amboinensis* Muir, Amboina. Owing to the habit of laying eggs in the cane stalks any of these species can be transported in cane shipments.

**Cicadidæ.**

*Mogannia hebes* Walker; Java.

**Aleyrodidæ.**

*Neomaskellia bergii* Signoret; Formosa, oriental regions.

*Aleurolobus longicornis* Zehntner, and *Aleyrodes lactea* Zehntner; Java.

**Aphididæ.**

*Oregma lanigera* Zehntner; Formosa; very injurious.

*Geoica lucifuga* Zehntner; Formosa.

**Miridæ (Capsidæ).**

*Lygus oryzæ* Matsumura and *L. sacchari* Matsumura; Formosa.

*Periscopus mundulus* Breddin; Java.

**Tingitidæ.**

*Serenthia formosana* Matsumura; Formosa.

*Leptodictya tabida* H. Schaeffer; Mexico.

**Lygæidæ.**

*Cymnus tabaci* Matsumura; Formosa.

*Colabathristes saccharicida* Karsch; Java.

**Coreidæ.**

*Cletus trigonus* Thunberg, *C. bipunctatus* H. S., *Riptortus fuscus* Fabricius, and *Leptocorisa varicornis* Fabricius; Formosa.

**Pentatomidæ.**

*Scotinophora tarsalis* Voll., *Menida histrio* Fabricius, *Nezara viridula* Linnæus, and *Coptosoma cribraria* Fabricius; Formosa.

## THYSANOPTERA.

*Heliothrips striatoptera* Kobus, *Physopus sexnotatus* Zehntner, *Oxythrips binervis* Kobus, *Parthenothrips* (?) *kobusi* Van Deventer, *Stenothrips* (?) *zehntneri* Van Deventer, *Thrips sacchari* Krüger, *T. serrata* Kobus, *T. minuta* Van Deventer, and *Phlœothrips lucasseni* Krüger; Java.

*Phlœothrips pallidicornis* Matsumura; Formosa.

## COLEOPTERA.

**Bostrychidæ.**

*Dinoderus minutus* Fabricius; India. (See Bamboo.)

**Scarabæidæ.**

*Oryctes rhinocerus* Linnæus (see Palms), *Xylotrupes dichotomus* Linnæus, and *Ligyrus rugiceps* Le Conte; the destructive scarabæids, whose larvæ feed at the cane roots; oriental regions.

*Xylotrupes gideon* Linnæus, *Anomala ænea* Perty, *Adoretus umbrosus* Fabricius (see Rose), and *Holotrichia leucophthalma* Wiedemann; the very destructive scarabæids, whose larvæ feed at the roots of cane; Java; oriental regions.

*Holotrichia vidua*; attacks cane in the Philippines.

**Tenebrionidæ.**

*Gonocephalum* (*Opatrum*) *acutangulum* Fairmaire, which bores in sugar cane and tobacco stalks.

**Elateridæ.**

*Agriotes formosanus*, *A. taichuensis*, *A. sacchari*, *Æolus vittatus*, *Cardiophorus devastans*, *C. formosanus*, *Ludius suturalis*, and *Lacon shirakii*, all described by Matsumura; Formosa and oriental regions.

**Chrysomelidæ.**

*Monolepta nigrobilineata* Motschulsky; *Colaspidea metallica* Rossi, a very injurious species; *Nodostoma lateralis* Matsumura and *Hispa callicantha* Baly; Formosa and oriental regions.

**Brachyrhinidæ.**

*Echinocnemus squameus* Billberg, *Myllocerus brunneus* Matsumura, *M. guttulus* Matsumura, *Episomus albinus* Matsumura, *Cneorhinus albiguttatus* Matsumura, *Phytoscaphus formosanus* Matsumura, *Tanymecus rusticus* Fabricius (a very injurious species); Formosa.

*Hypomeces unicolor* Fabricius, which breeds at the roots of young cane and also attacks rice; Java.

**Curculionidæ.**

*Lixus vetula* Fabricius; Formosa.

*Baris saccharivora* Matsumura; Formosa.

**Calandridæ.**

*Rhynchophorus palmarum* Linnæus; Trinidad. (See Coconut palm.)

*Cosmopolites sordidus* Germar; Pacific Islands. (See Banana.)

## LEPIDOPTERA.

**Rhopalocera.**

*Cyllo leda* Linnæus, *Discophora celinde* Stoll, *Pamphila dara* Kollar, *Hesperia philino* Möschler, *H. conjuncta* H. S.; Java.

*Parnara mathias* Fabricius and *Telicota augias* Linnæus; *Mycalesis mineus* Linnæus and *Melanitis leda* Linnæus; Formosa and oriental regions.

**Sphingidæ.**

*Leucophlebia lineata* Westwood; Formosa, Java.

**Notodontidæ.**

*Anticyra combusta* Moore (*Phalera*); Java.

**Cnethocampidæ.**

*Dreata petola* Moore; Java.

**Arctiidæ.**

*Phissama interrupta* Linnæus; Java.

**Lymantriidæ.**

*Psalis securis* Hübner, *Euproctis minor* Snellenhoeven, *Lælia subrufa* Snellenhoeven, *Procodeca adara* Moore, and *Aroa socrus* Hübner; Java.

*Laelia costalis* Matsumura; Formosa.

*Euproctis flavata* Cramer; oriental regions.

**Noctuidæ.**

*Sesamia nonagrioides* Lef., *Spodoptera pecten* Guénée, *Agrotis interjectionis* Guénée, *Remigia frugalis* Fabricius (see text fig. 100); Java.

*Nonagria exitiosa* Oliff is destructive to cane in New South Wales.

*Nonagria inferens* Walker, which is very injurious to cane in Formosa; *Cirphis unipuncta* Haworth, a cosmopolitan pest; and *L. loreyi* Dup; Formosa.

*Nonagria uniformis;* India. (See pl. XLIV, figs. c, f, i, o.)

**Pyralidæ.**

*Botys coelesalis* Walker, *Cnaphalocrocis bifurcalis* Snellenhoeven, *Scirpophaga intacta* Snellenhoeven, and *Chaetosticha nana* Zehntner; Java.

*Chilo infuscatella* Snellenhoeven, *Scirpophaga auriflua* Zeller, a serious borer (see pl. XLIV, figs. b, h, l, n, r), and *Diatræa striatalis* Snellenhoeven; Formosa and oriental regions.

*Anerastia ablutella* Zeller; India; borer. (See pl. XLIV, figs. e, k.)

*Chilo auricilia* Dudgeon; India. (See Rice.)

*Scirpophaga chrysorrhœa* Zeller and *S. monostigma* Zeller (see pl. XLIV, fig. g); India; very injurious borers.

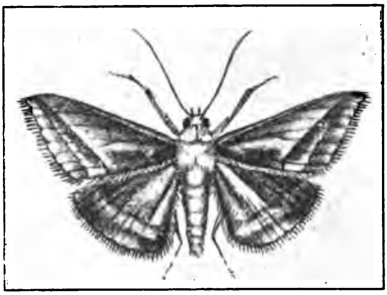


Fig. 100.—Cane moth (*Remigia frugalis*) (Maxwell-Lefroy).

**Elachistidæ.**

*Cosmopteryx pallifasciella* Snellenhoeven; Java.

*Autosticha pelodes* Meyrick breeds in dead cane leaves and other plants in Hawaii.

**Tortricidæ.**

*Eucosoma schistacea* Snellenhoeven; causes much injury by boring in the stems; Formosa.

**Phycitidæ.**

*Cryptoblabes aliena* Swezey attacks green cane leaves, corn, and sorghum, as well as other plants.

**Tineidæ.**

*Ereunetis pilosata* Swezey and *E. muiriella* Swezey of British New Guinea attack the cane exactly as *E. flavistriata; Opogonia aurisquamosa* Butler of Hawaii, Marquesas, and Society Islands; *O. apicalis* Swezey of Hawaii; *O. dimidiatella* Zeller of Java; *O. saccharella* Swezey, and *O. fumiceps* Felder of British New Guinea attack the wet dead leaves and lower buds of cane.

## LITERATURE.

Matsumura, S. Die Schädlichen und Nützlichen Insekten vom Zuckerrohr Formosas, The Keiseisha, Tokyo, 1910. Also in Zeit, f. wiss. Ins. biol., band. 6, pp. 101-104; 136-139.

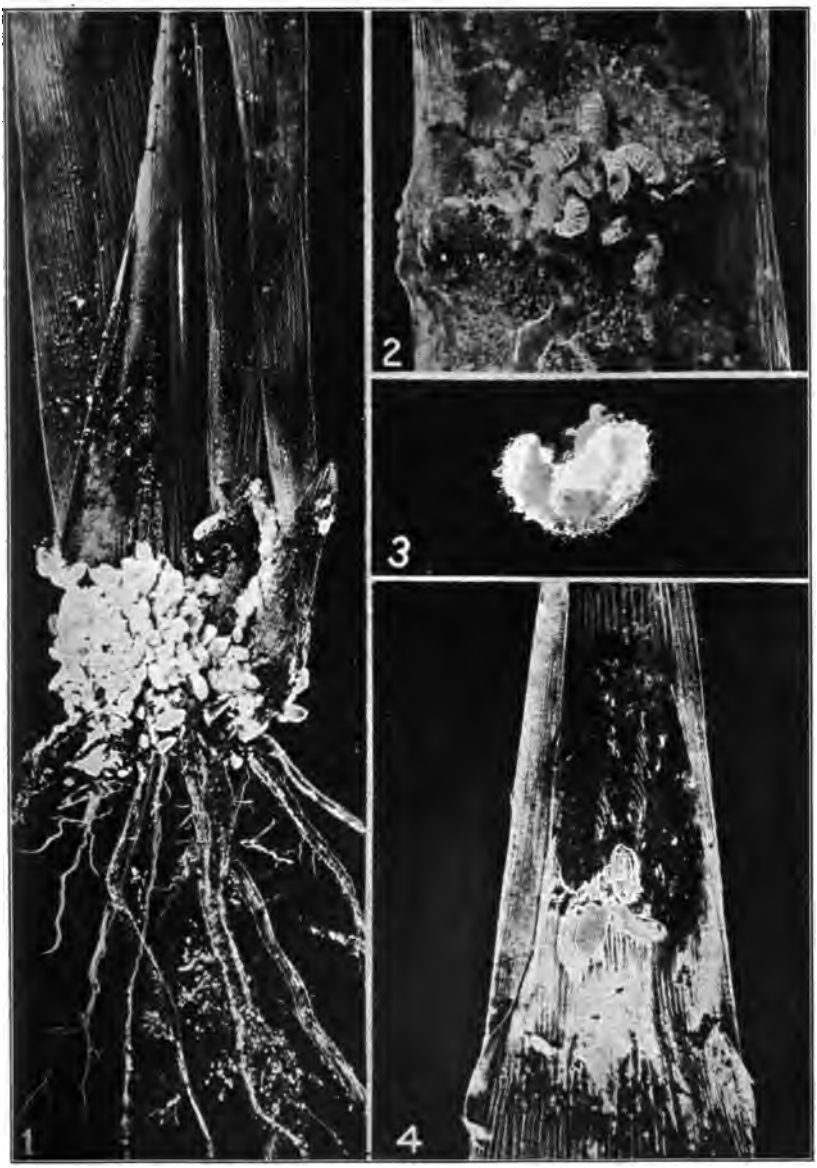
Van Deventer, W. Handboek voor de Suikerriet-cultuur, Java, vol. 2, 1906.

Muir, F. Hawaiian Sugar Planters' Assn., Entom. bul. 9, 1910, 11 pp., 5 figs.

Heidemann, O. Journ. Econ. Entom. 1913, vol. 6, pp. 249-251, fig. 1.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.

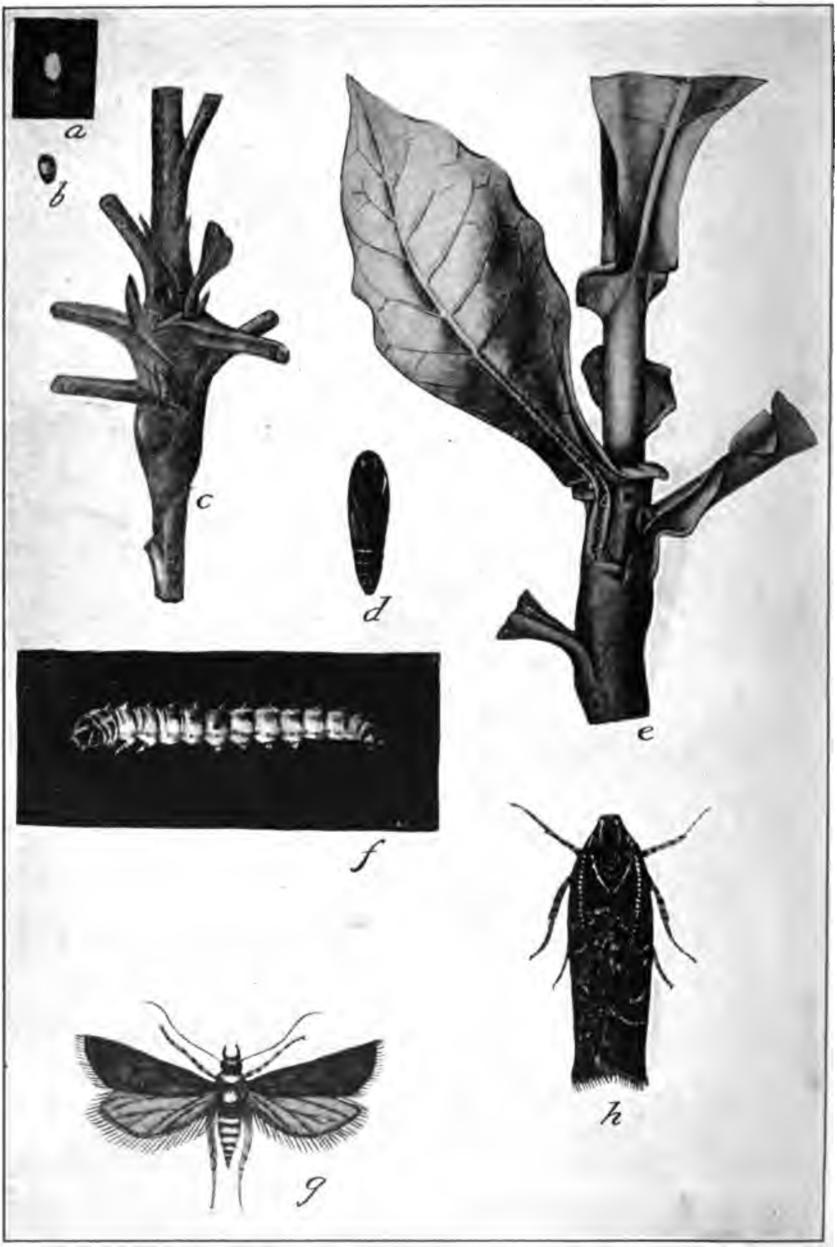
Swezey, E. P. Hawaiian Sugar Planters' Assn. Bul. 6, 1909.



THE SUGAR-CANE MEALY-BUG.

The sugar-cane mealy-bug (*Pseudococcus calceolariae*): FIG. 1.—Adult mealy-bugs clustered about base of young cane. FIG. 2.—Adult females, enlarged. FIG. 3.—Single adult with mealylike covering. FIG. 4.—Cocoons. (Van Dine.)

UNIV. OF MIC



THE TOBACCO STEM-BORER.

The tobacco stem-borer (*Gnorimoschema heliopa*): FIGS. *a*, *b*.—Eggs. FIGS. *c*, *e*.—Injury. FIG. *d*.—Pupa. FIG. *f*.—Larva. FIGS. *g*, *h*.—Adults. (Maxwell-Lefroy.)

## SWEET POTATO.

(*Ipomœa batatas* Poir. Family Convolvulaceæ.)

The sweet potato is now grown in many parts of the world, and, while not often shipped into the United States because of our own bountiful crops, there is always likelihood of danger in shipment of tubers for propagation purposes. The only enemies of the vine which are dangerous are those which attack the tubers.

### A. BETTER KNOWN SWEET-POTATO INSECTS LIKELY TO BE IMPORTED.

#### **Cylas brunneus** Fabricius.

(Liberian Sweet-Potato Borer. Curculionoidea: Coleoptera.)

*Host:* Sweet potato.

*Injury:* Attacks tubers in a manner similar to *C. formicarius*. Liable to introduction in the tubers.

*Description:* A wingless elongate weevil with body constricted in front of elytra; unicolorous, brown, bronzy or black, of the same form as *C. formicarius*.

*Distribution:* Liberia.

#### * **Cylas formicarius** Fabricius.

(Sweet-Potato Weevil. Curculionoidea: Coleoptera.)

*Host:* Sweet potato.

*Injury:* Very serious pest of sweet-potato tubers.

*Description and biology: Adult* an elongate weevil, with steel-blue elytra, reddish prothorax and legs and darker head; about 0.33 inch in length. *Pupa* white, elongate with all appendages folded underneath. *Larva* a white footless grub with dark-brown head; bores in the tubers of the sweet potatoes and pupates in its burrows. It attacks the tubers both in the field and in storage.

*Distribution:* Nearly cosmopolitan; Florida to Texas, but not present in all sweet-potato sections of the United States.

BASU, S. K., and DUTT, H. L. Crop Pest Handbook for Behar and Orissa, 1913, Calcutta, Leaflet 71, pl. 47.

#### **Euscepes batatæ** Waterhouse. (**Cryptorhynchus.**)

(West Indian Sweet-Potato Weevil. Curculionidæ; Coleoptera.)

*Host:* Sweet potato.

*Injury:* Bores in the tuber. Very easily distributed. This weevil is caught in quarantine in almost every shipment of sweet potatoes from Hawaii to California but has not yet become established.

*Description and biology: Weevil* elliptical, brown, covered with flat scales and bristling with stiff erect scales; beak short, concealed on breast when at rest. Pupa white, oval with two apical spines. *Larva* curved, white, legless with chitinous head.

*Distribution:* West Indies (Barbados, Antigua), Hawaii.

FULLAWAY, D. T. Hawaii Agr. Exp. Sta., 1911, Bul. 22, pp. 27–29, fig. 9.

WHITNEY, L. A. Monthly Bulletin California St. Comm. Horticulture, 1915, vol. 4, pp. 162–164, figs. 24–28.

#### **Omphisa anastomosalis** Guénée.

(Sweet-Potato Stem Borer. Pyralidæ; Lepidoptera.)

*Host:* Sweet potato, other garden crops.

*Injury:* Bores in the stem and sometimes into the tuber, in which case it can easily be disseminated.

*Description and biology: Moth* white, with the body suffused with ocherous and rufous, leaving some pale spots on the dorsum; forewings with rufous suffusion on basal area extending below median nervure to middle of wing, hyaline patches at middle and end of cell, rufous edged ocherous spot between them, and another beyond cell, curved postmedial rufous line with irregularly dentate line beyond it inclosing series of hyaline patches; hind wings with base rufous, two irregularly waved rufous post-medial lines; expanse 32–36 mm. *Larva* 30 mm. long, pale yellowish white, with conspicuous brown tubercles. *Eggs* elliptical, flat or moderately rounded, laid on leaves.

*Distribution:* China, India, Ceylon, Java. Introduced into Hawaii about 1900 and has become quite a pest.

Fullaway, D. T. Hawaii Agr. Exp. Sta., 1911, Bul. 22, pp. 16–19, fig. 6.

### B. IMPORTANT SWEET-POTATO INSECTS.

#### HEMIPTERA.

**Jassidæ and Fulgoridæ.**
*Nesosydne ipomœicola* and *Aloha ipomœæ*; Hawaii.

#### COLEOPTERA.

*Conchyloctenia punctata* Fabricius; Africa; sometimes serious.

**Scarabæidæ.**
*Adoretus umbrosus tenuimaculatus* Waterhouse; Hawaii, Japan.

**Chrysomelidæ.**
*Aspidomorpha militaris* Fabricius; India, Java; leaf beetle.

#### LEPIDOPTERA.

**Noctuidæ.**
*Agrotis crinigera*, *A. dislocata*, *A. saucia* Hübner, *Spodoptera mauritia* Boisduval, *Laphygma exigua* Hübner, *L. reclusa* and *Plusia chalcites* Esp.; Hawaii; cutworms.

**Sphingidæ.**
*Herse convolvuli* Linnæus; Hawaii, United States.

**Tineidæ.**
∗*Bedellia minor* Busck; Hawaii, Florida; leaf miner.
*Bedellia somnulentella* Zeller; Cosmopolitan.
*Bedellia orchilella* Walsingham, Hawaii; an important leaf miner.

**Pyralidæ.**
*Phlyctænia despecta* Butler; Hawaii; leaf roller.

**Tortricidæ.**
*Amorbia emigratella* Busck; South America, Hawaii; leaf roller.

## TAMARACK.

See Conifers.

## TAMARIND.

(*Tamarindus indicus* L. Family Leguminosæ.)

An ornamental shade tree grown everywhere in the Tropics. It is grown in southern Florida and California and is used in conservatories in more northern countries. The pods contain a pleasant pulp used in the Tropics as a basis for a cooling drink. This pulp is also used in medicine. The wood is valuable for furniture.

### IMPORTANT TAMARIND INSECTS.

#### COLEOPTERA.

**Mylabridæ.**
*Caryoborus gonagra* Fabricius; India, breeds in seed.

**Calendridæ.**
*Calendra linearis* Herbst; Brazil, West Indies.
∗*Calendra rugicollis* Casey, Key West, Fla.; breeds in seed in pod.

**Tenebrionidæ.**
∗*Palembus ocularis* Casey; Key West, Fla.

Stebbing, E. P. Indian Forest Insects. Coleoptera, 1914.

## TAMARISK.

(*Tamarix* spp. Family Tamariscaceæ.)

Ornamental trees or shrubs occurring from Mediterranean regions to East Indies and Japan. *Tamarix gallica* is planted in many places on our Gulf coast. Several species have medicinal properties and yield dyestuffs. The punctures of *Coccus manniparus* cause *Tamarix mannifera* to produce "manna."

### IMPORTANT TAMARISK INSECTS.

#### COLEOPTERA.

**Curculionidæ.**

*Coniatus lætus* Miller, and *C. suavis* Gyllenhal, Europe; breed on the leaves.
*Nanophyes tamaricis* Gyllenhal; Europe; breeds in the ovaries of *Tamarix gallica*.

Bargagli, P. Rassegna Biologica Rincofori Europei, 1883–87.

## TEA.

(*Thea sinensis*. Family Ternstrœmiaceæ.)

The tea plant is a flowering shrub much valued for its leaves, which yield the universally used beverage. It occurs in China and India and is also propagated in this country. Other species of the genus are much prized as flowering shrubs.

### A. BETTER KNOWN TEA INSECTS LIKELY TO BE IMPORTED.

#### **Xyleborus fornicatus** Eichhoff.

(Shot-hole borer of tea. Ipidæ; Coleoptera.)

*Host:* Tea, coffee, cacao.

*Injury:* Tunnels in pith of young twigs and in wood of old trunks. Very injurious.

*Description and biology.—Beetle* oblong, shining, fuscous, 1–4 mm. long; *larva* develops into beetles in fallen twigs.

*Distribution:* Ceylon, Java, India.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 575.

#### **Biston suppressarius** Gn.

(Indian Tea Geometrid. Geometridæ; Lepidoptera.)

*Hosts:* Tea, *Dodonea viscosa*, *Carissa diffusa*, *Bauhinia variegata*, *Acacia catechu*, *Acacia modesta*, *Rothra tinctoria*, *Cassia auriculata*, *Albizzia*.

*Injury:* Serious as defoliator of tea and forest trees.

*Description and biology: Moth*, gray with black markings. *Larva* green. Has three broods a year.

*Distribution:* India.

Stebbing, E. P. Manual Forest Zoology, India, 1908, p. 133, fig. 267.

#### **Psyche** spp., etc.

(Tea Bagworms. Psychidæ; Lepidoptera.)

*Species: Psyche albipes* Moore; Ceylon; tea. *Psyche assamica* Watt; India; tea. *Acanthopsyche reidi* Watt; India; tea. *Acanthopsyche snelleni* Heyl; India; tea. *Amatissa consorta* Templeton; India, Ceylon; tea. *Clania variegata* Snell.; India, Ceylon, Java; tea, cinchona, coffee. *Clania crameri* Westwood; India; tea, cinchona, coffee, *Pinus longifolia*. *Clania holmesi* Wall; India; tea.

*Injury:* Feed on foliage, twigs, and bark.

*Biology:* The larvæ feed in bags made from scraps of bark, etc.

Watt and Mann. Pests and Blights of the Tea Plant, Calcutta, 2d ed., 1903, pp. 188–200, figs. 13–15, portions of pls. 7, 8.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 328, 329.

### B. OTHER IMPORTANT TEA INSECTS.

#### ACARINA.

**Tetranychidæ.**

*Tetranychus bioculatus* Wood-Mason. (See Coffee.)

#### HEMIPTERA.

**Coccidæ.**

**Fiorinia theæ* Green; cosmopolitan; tea, olive, etc. (See pl. V, fig. 1.)
**Orthezia insignis* Douglas; cosmopolitan; tea, citrus (See pl. IV, fig. 2.)
**Coccus hesperidum* Linnæus; cosmopolitan; tea, citrus, palms. (See pl. II, fig. 2.)
*Pulvinaria theæ* Froggat; Australia; *Thea viridis*.
*Coccus viridis* Green; Ceylon, Hawaii.

#### LEPIDOPTERA.

**Cossidæ.**

*Zeuzera coffeæ* Nietner; borer. (See Coffee.)

**Cochlidiidæ.**

*Belippe albiguttata* Linnæus, serious injury in Java.

**Zygænidæ.**

*Heterusia cingala* Moore; serious in Ceylon, India.

**Geometridæ.**

*Ophthalmodes cretacea* Butler; Japan.

**Lymantriidæ.**

*Euproctis divisa* Walker and *E. latifascia* Walker; Orient. *Dasychira mendosa* Hübner, *D. misana* Moore, *D. thwaitesi* Moore; India, Ceylon, Java. *Orgyia postica* Walker; Java, Ceylon. *Andraca bipunctata* Walker; India.

**Notodontidæ.**

*Stauropus alternus* Walker; India, Ceylon, Java.

## TEAK.

(*Tectona grandis*. Family Verbenaceæ.)

A valuable timber tree of the Orient.

### IMPORTANT TEAK INSECTS.

#### COLEOPTERA.

**Cucujidæ.**

*Silvanus advena* Walth.; India; breeds in leaves, forming galls, causing leaves to drop.

**Malacodermidæ.**

*Plateros dispallens* Walker; India; oviposits in clusters on twigs; defoliates trees.

**Buprestidæ.**

*Psiloptera fastuosa* Fabricius; India; bores in wood.

**Elateridæ.**

*Adelocera modesta* Boisduval; India; bores in bast and sapwood.

**Chrysomelidæ.**

*Aspidomorpha sanctæcrucis* Fabricius; India; a tortoise-shell beetle; defoliates.

**Cerambycidæ.**

*Stromatium barbatum* Fabricius; India; bores in wood of saplings. *Stromatium longicorne* Newman; India; a very serious borer. *Gelonætha hirta* Fairmaire and *Xylotrechus smei* Lap. et Gory; India; bore in bast and sapwood.

**Brachyrhinidæ.**

*Astycus lateralis* Fabricius; India. *Myllocerus viridanus* Fabricius; India; a serious defoliator. *Myllocerus carinirostris* Marshall and *M. discolor variegatus* Boheman; India. *Cyrtepistomus pannosus* Marshall; India; a defoliator as an adult.

#### LEPIDOPTERA.

**Cossidæ.**

*Cossus cadambe;* India; bores in wood of lopped trees. *Duomitus ceramicus;* India; bores in wood and is very destructive.

Stebbing, E. P. Indian Forest Insects, Coleoptera, 1914.
Stebbing, E. P. A Manual of Forest Zoology for India, 1908.

## TIMBER.

### ⁎ Nacerdes melanura Linnaeus.

(Timber Beetle. Œdemeridæ; Coleoptera.)

*Host:* Bores in wharf timber, creosoted and untreated piling, paving blocks, and pine flooring.

*Injury:* Reported as doing considerable damage at Auckland, New Zealand.

*Description: Beetle* 12 mm. long, elongate, subdepressed, brownish yellow or reddish, with yellowish pubescence; dilated sides of thorax, femora, tibiæ, and tips of elytra blue or blackish. *Pupa* 16 mm. long, creamy colored, with two median and two lateral protuberances on apical segment. *Larva* 24 mm. long, cylindrical, tapering toward apex; creamy colored, front of head light brown; mandibles black; legs short; third and fourth abdominal segments swollen beneath and with two protuberances each; ninth abdominal segment somewhat bent, with transverse fissure at apex.

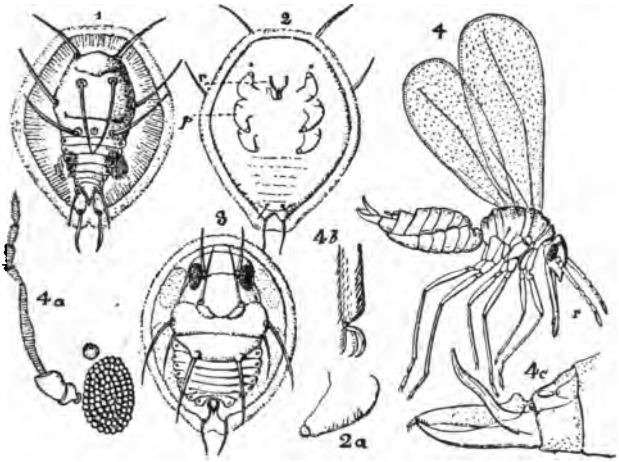


Fig. 101.—Tobacco white fly (*Aleyrodes tabaci*): 1, pupa case, dorsal view; 2, pupa case, ventral view; 2*a*, larval leg; 3, more mature pupa case, dorsal view; 4, adult male; 4*a*, male antenna and eye; 4*b*, tip of tarsus; 4*c*, tip of male abdomen. (Targioni-Tozzetti.)

*Distribution:* Europe, introduced into New Zealand, Eastern United States.

Brown, T. Tenth Rept. New Zealand Dept. Agric., 1902, pp. 460–463, figs. 1–7.

## TIMOTHY.

(*Phleum pratense* Linnæus. Family Gramineæ.)

This grass is a native of Europe now extensively cultivated in America for hay. A discussion of its insect pests will be found under Grains and Grasses.

## TOBACCO.

(*Nicotiana tabacum* Linnæus. Family Solanaceæ.)

Tobacco is grown in many parts of the world and is a very important article of commerce in various forms. Commercial importations generally consist of manufactured products, loose leaf, stem, and seed. The greatest dangers lie in the manufactured products and loose-leaf tobacco. There are at present no quarantine restrictions on tobacco. The tobacco plant has many very important enemies in foreign countries, which are not extremely likely to enter the country in connection with tobacco shipments, but which should be guarded against. Many of these important insects are listed to assist in the work of identification.

### A. BETTER KNOWN TOBACCO INSECTS LIKELY TO BE IMPORTED.

### Aleyrodes spp.

(Tobacco White Flies. Aleyrodidæ; Hemiptera.)

*Species: A. tabaci* Gennadios; Greece; tobacco. (See text fig. 101.) ⁎ *Trialeurodes vaporariorum* Westwood, cosmopolitan; many hosts.

*Injury:* Suck juices from foliage; injure value of tobacco leaf.
*Description:* *Adults* tiny white flies.

KIRKALDY, G. W. Hawaii Bd. Comm. Agr. and Forestry, Bull. 2.
TARGIONI-TOZZETTI, AD. Animali ed Insetti del Tabacco, 1891, pp. 246–249, fig. 86.

### **Catorama tabaci** Guérin-Meneville.

(Tobacco Beetles. Anobiidæ; Coleoptera.)

*Hosts:* Stored products.
*Injury:* Attacks dried tobacco.
*Description and biology:* *Adult* beetle ovate-discoidal, convex, brown, covered with whitish pubescence, about 5 mm. long. *Larva* similar to that of *Lasioderma.*
*Distribution:* Europe.

TARGIONI-TOZZETTI, AD. Animali ed Insetti del Tabacco, 1891, pp. 92, 93.

### **Agriotes lineatus** Linnæus.

(Tobacco Wireworm. Elateridæ; Coleoptera.)

*Hosts:* Tobacco, grain, potatoes, beets, peas, clover, cabbage, hops, corn, carrots, lettuce, peach, etc.
*Injury*: Larvæ tunnel the roots and sometimes stems.
*Description and biology:* *Adult* a snapping beetle 7–8 mm. long, brown with griseous pubescence; second and fourth elytral intervals blackish; antennæ, anterior margin, and posterior angles of prothorax reddish brown. *Larvæ* elongate, chitinous wireworms; feed in the roots and stems of plants and cause much damage.
*Distribution:* Europe, Asia, Africa.

TARGIONI-TOZZETTI, AD. Animali ed Insetti del Tabacco, 1891, p. 81, figs. 30, 31.
SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 482, fig. 295c.

### **Agriotes pilosus** Lacordaire.

(Tobacco Wireworm. Elateridæ; Coleoptera.)

*Host:* Tobacco.
*Injury:* Larvæ tunnel the plants.
*Description and biology:* *Adult* a snapping beetle, black, 12–14 mm. long. *Larva* 25 mm. long, chitinous, wireworm, feeds in the roots and stems.
*Distribution:* Bessarabia, Portugal.

LINDEMAN, K. VON. Die Schädlichsten Insekten des Tabak in Bessarabia, 1888, Moscou.
TARGIONI-TOZZETTI, AD. Animali ed Insetti del Tabacco, 1891, p. 82.

### **Athous niger** Linnæus.

(Tobacco Wireworm. Elateridæ; Coleoptera.)

*Hosts:* Tobacco, beets.
*Injury:* Larvæ tunnel the plants.
*Description and biology:* *Adult,* snapping beetle, shining black with cinereous pubescence; length 11–12 mm. *Larva* 18–20 mm. long; a wireworm which feeds in the roots of tobacco and other plants.
*Distribution:* Europe.

LINDEMAN, K. VON. Die Schädlichsten Insekten des Tabak in Bessarabia, 1888, Moscou.
TARGIONI-TOZZETTI, AD. Animali ed Insetti del Tabacco, p. 79.

### Gnerimoschema heliopa Low.

(Tobacco Stem Borer. Gelechiidæ; Lepidoptera.)

*Host:* Tobacco.

*Injury:* Very injurious as a stem borer. Stems having swellings should be destroyed.

*Description and biology: Adult* moth small and brown with narrow fringed wings. *Pupa* stage is spent in stem. *Larva,* caterpillar bores into the leaf stem and bores downward in the stalk, causing a swelling to appear in two or three weeks. In cold weather this stage lasts 6 to 10 weeks. *Eggs* deposited singly upon leaves, stems, and stalks, usually upon the lower side of leaves or stems. In cold weather this stage lasts 2 or 3 weeks. Warm weather reduces the development from about a third to a half. (See plate XLVII.)

*Distribution:* Australia, Ceylon, India.

MAXWELL-LEFROY, H. F. Indian Insect Pests, 1906, Calcutta.

BASU, S. K., and DUTT, H. L. Crop Pest Handbook for Behar and Orissa, 1913. Dept. Agr. Behar and Orissa, Calcutta. Leaflet 53, Pl. 36.

### *Phytomyza affinis Fallen (nigricornis Macquart).

(Marguerite fly. Agromyzidæ; Diptera.)

*Hosts:* Tobacco, *Cineraria, Cosmos, Helianthus, Geranium, Dahlia, Chrysanthemum,* marigold, nasturtium, lettuce, celery, carrot, parsnip, pea, cape weed, dandelion, etc.

*Injury:* Mines the leaves, destroying their value for high-grade products. Might be distributed in celery or tobacco.

*Description and biology: Adult* fly very tiny. *Pupa* is formed in leaf mine *Larva* tunnels the leaf. *Egg* laid on under surface.

*Distribution:* Tasmania, New Zealand, Australia, Europe, United States.

LEA, A. M. Insect and Fungous Pests of the Orchard and Farm, Hobart, Tasmania, pp. 81–84.

## B. OTHER IMPORTANT TOBACCO INSECTS.

### ORTHOPTERA.

**Gryllidæ and Locustidæ.**

*Acridium migratorium* Fieber, and *Anisolabris maritima* Fieber; Europe.
*Atractomorpha crenulata* Fabricius; India.
*Brachytrypes achatinus* Stoll; Asia.
*Caloptenus italicus* Burmeister; Mediterranean Regions.
*Chrotogonus trachypterus* Blanchard; India.
*Locusta viridissima* Fabricius; Europe, Asia, Africa.
*Pachytus sulcicollis;* Transvaal.

**Gryllotalpidæ.**

*Gryllotalpa gryllotalpa* L. (*vulgaris* Latreille); Europe.
*Gryllotalpa africana* Pal. B.; widely distributed.
*Schizodactylus monstrosus* Drury; Asia.

### HEMIPTERA.

**Miridæ (Capsidæ).**

*Gallobellicus crassicornis* Distant; India.

**Lygæidæ.**

*Cymnus tabaci* Matsumura; Formosa.
*Nysius minor* Distant; India.

**Pentatomidæ.**

*Nezara viridula* Linnæus; Transvaal.

### COLEOPTERA.

**Scarabæidæ.**

*Adoretus umbrosus* Fabricius; Hawaii; feeds on leaves.
*Melolontha vulgaris* Fabricius of Europe; *M. rufipes* Herbst of Europe, Asia, Africa; *M. tenebrosus* Kiesenwetter, *M. niger* Fabricius; and *M. castaniptes* Paykull; breed at roots of tobacco.

**Scarabæidæ**—Continued.

*Cetonia lugubris* Voet; Europe; breeds in tender bark above the ground, causing reddening of plant. (See text fig. 102.)

*Pentodon punctatus* Kirby; Europe; Africa; larva destructive to roots.

*Oxythyrea funesta* Poda; Italy; damages leaves.

**Tenebrionidæ.**

*Blaps mucronata* Latreille; Italy.

*Entochira lateralis* Boheman; Java. (See Sugar cane.)

*Gonocephalum intermedium* Fischer; Bessarabia; causes stunted growth by boring.

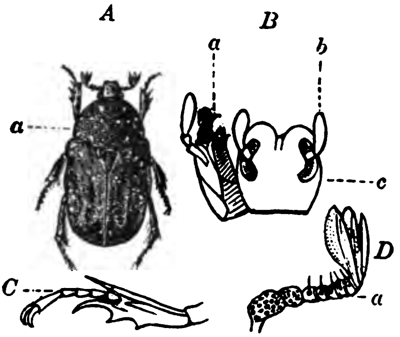


Fig. 102.—Tobacco beetle (*Cetonia lugubris*). (Targioni-Tozzetti.)

*Gonocephalum acutangulum* Fairmaire; Java; bores in stalks: *G.* (*Opatrum*) *pusillum* Fabricius; Europe; borer.

*Pedinus femoralis* Mulsant; Bessarabia.

**Curculionidæ.**

*Cleonus punctiventris* Germar; Europe. (See Beet.)

LEPIDOPTERA.

**Noctuidæ.**

*Agrotis trux* Hübner of Europe, *A. segetum* Schiffermiller (see text fig. 103) of Europe, *Amsacta lactinea* Cr. of Asia (see text fig. 104), *A. moorei* of Asia, *A. lineola* Fabricius of India and Ceylon; cutworms.

*Laphygma reclusa;* Orient.

*Chloridea peltigera* Schiffermiller, and *C. assulta* Guénée; India.

*Euxoa spinifera* Hübner; Europe, Asia, Africa.

*Mamestra brassicæ* Linnæus and *M. albicolor* Hübner; Italy.

*Micromima olivia;* Cuba, leaf roller on tomato, tobacco, and eggplant.

*Plusia gamma* Linnæus; Europe, and *P. argentifera;* Tasmania.

*Prodenia litura* Fabricius; Asia, Africa, Australia. (See text fig. 105.)

*Spodoptera mauritia* Boisduval, and *Triphæna pronuba* Linnæus; very widely distributed. (See text fig. 106.)

**Gelechiidæ.**

**Phthorimæa operculella* Zeller. (See Potato.)

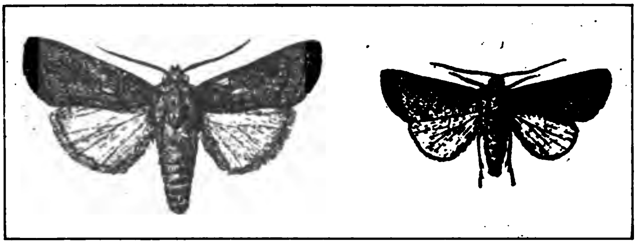


Fig. 103.—Tobacco cutworm (*Agrotis segetum*): Adult. (Targioni-Tozzetti.)

LITERATURE.

TARGIONI-TOZETTI, AD. Animali ed Insetti del Tabacco en Erba e del Tabacco Secco, 1891. Firenze-Roma.

MAXWELL-LEFROY, H. F. Indian Insect Pests. 1906. Calcutta.

LINDEMAN, K. VON. Die Schädlichsten Insekten des Tabak in Bessarabia. 1888. Moscow.

MAXWELL-LEFROY, H. F. Indian Museum Notes, Vol. 3.

VARIOUS AUTHORS in Memoires Dept. Agr. India, Entomological Series.

HOWARD, C. W., in Transvaal Agricultural Journal during 1907 and 1908.

FULLAWAY, D. T. Hawaii Agr. Expt. Sta., 1914, Bul. 34.

JONES, C. R. Philippine Agr. Rev., 1913, v. 6, no. 9.

## TODDY PALM.

(*Phœnix sylvestris.* Family Palmaceæ.)

A palm much cultivated in India for its sap, which yields sugar and "toddy." (See Palms.)

## TOMATO.

(*Lycopersicum esculentum.* Family Solanaceæ.)

The much-prized garden fruit grown very extensively in this country.

### A: BETTER KNOWN TOMATO INSECTS LIKELY TO BE IMPORTED.

#### Desiantha nociva Lea.

(Tomato Weevil. Curculionidæ; Coleoptera.)

*Host:* Tomato, potato, and other vegetable plants.

*Injury:* Larvæ and adults feed on and destroy the plants. They are nocturnal feeders, hiding in the soil by day.

*Description: Weevil* elongate, about 12 mm. long, brown with black dots. *Larva* pea green in color. *Pupates* in cell in soil.

*Distribution:* Australia.

French, C. Handbook Destructive Insects Victoria, pt. 5, 1911, pp. 40–43, pl. 105.

French, C. Journ. Dep. Agr. Victoria, pp. 12, 13, Dec., 1913.

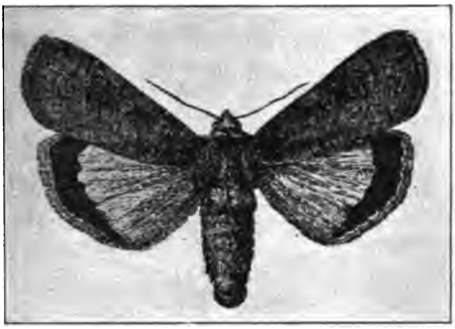


Fig. 104.—Tobacco cutworm (*Amsacta lactinea*): Adult. (Maxwell-Lefroy.)

#### Lonchæa splendida.

(Metallic Tomato Fly. Trypetidæ; Diptera.)

*Hosts:* Tomato, potato, eggplant, other Solanaceæ.

*Injury:* Breeds in fruit, attacking perfectly healthy tomatoes.

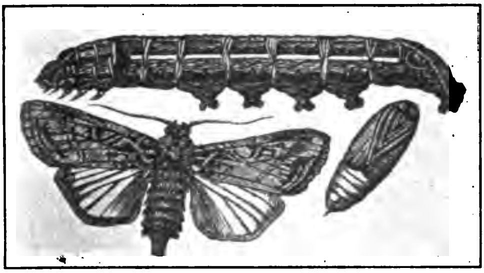


Fig. 105.—Tobacco cutworm (*Prodenia litura*): Larva, pupa, adult. (Maxwell-Lefroy.)

*Description:* Fly, metallic bluish green or dark bronze green, wings smoky pink, head and legs black, body tapering, eyes large and prominent.

*Distribution:* New Zealand, Australia, Pacific Islands.

### B. OTHER IMPORTANT TOMATO INSECTS.

LEPIDOPTERA.

**Gelechiidæ.**

**Phthorimæa operculella* Zeller. (See Potato.)

**Noctuidæ.**

*Micromima olivia;* Cuba; leaf roller on tomato, tobacco, and eggplant.

DIPTERA.

**Trypetidæ.**

*Dacus cucurbitæ* Coquillett; India, Ceylon, Hawaii; attacks fruit. (See Cucurbits.)

*Ceratitis capitata* Wiedemann; attacks fruit. (See Fruit.)

## TOON.

(*Cedrela toona*, etc. Family Meliaceæ.)

Tall ornamental trees of the Tropics; some species cultivated in California and the Gulf States.

### AN INSECT INJURIOUS TO TOON.

LEPIDOPTERA.

**Pyralidæ.**

*Hypsipyla robusta* Moore; India; bores in flowers, buds, fruit, and twigs of toon (*Cedrela toona*).

STEBBING, E. P. A Manual of Forest Zoology for India, 1908.

## TROPICAL ALMOND.

(*Terminalia* spp. Family Combretaceæ.)

Tropical plants, chiefly of the Old World, some of them with edible seed. *T. catappa* is cultivated in Florida and Porto Rico.

### IMPORTANT TERMINALIA INSECTS.

THYSANOPTERA.

* *Heliothrips rubrocinctus* Giard; West Indies, Ceylon, Uganda, Florida. (See Avocado.)

COLEOPTERA.

**Bostrychidæ.**

*Sinoxylon crassum* Lesne; India; bores in wood of *Terminalia tomentosa, T. chebula.*

*Sinoxylon anale* Lesne; India; bores in wood of *Terminalia bellerica.*

*Lyctus spinifrons* Lesne; India; bores in posts of *Terminalia tomentosa.*

**Buprestidæ.**

*Psiloptera viridans* Kerremans; India; bores in wood of *Terminalia tomentosa.*

*Chrysobothris indica* Cast. et Gory; India; bores in wood of *Terminalia tomentosa.*

**Cerambycidæ.**

*Æolesthes holosericea* Fabricius; India; bores in wood of *Terminalia tomentosa.*

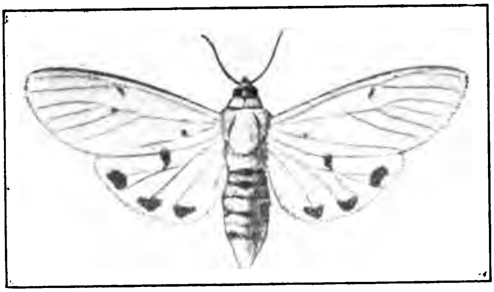


Fig. 106.—Tobacco cutworm (*Triphaena pronuba*): Adult. (Targioni-Tozzetti.)

**Brentidæ.**

*Ceocephalus carus* Walker; India; bores in wood of *Terminalia tomentosa.*

**Platypodidæ.**

*Platypus cupulatus* Chapuis; India; bores in wood.

DIPTERA.

**Trypetidæ.**

*Ceratitis capitata* Wiedemann; attacks *Terminalia catappa.* (See Fruit.)

STEBBING, E. P. Indian Forest Insects, Coleoptera, 1914.

## TURNIP; RUTABAGA.

(*Brassica rapa, Brassica campestris.* Family Cruciferæ.)

These root crops will bear watching for root pests.

### IMPORTANT TURNIP INSECTS.

**Meligethes æneus** Fabricius.

(Turnip Flower Beetle. Nitidulidæ; Coleoptera.)

*Hosts:* Turnip, rape, cabbage, and other crucifers.

*Injury:* Does considerable damage to the buds and flowers, causing stunted and shriveled appearance.

*Description and biology: Adult* metallic green, sometimes with a bluish shimmer; sides parallel, head and apex rounded, legs dark brown; fore tibiæ lighter, small externally saw-toothed; body 2–2.5 mm. long, 1.5–2 mm. broad. *Larva* yellowish white, head dark; mandibles with darker apex and a double row of short teeth; length 4.5 mm. During the first week in June the beetles may be found in numbers in blossoms, apparently feeding on the pollen. The eggs are deposited within the unopened buds. The larvæ feed in the buds and flowers and cause stunting and shriveling. Pupation takes place in earthen cells.

*Distribution:* Europe.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 474, figs. 288–289.

ORMEROD, E. A. Fifteenth Report Injurious Insects, London 1892, p. 96, fig. (adult).

### Trichocera hiemalis.

(Winter Turnip Gnat. Mycetophilidæ; Diptera.)

*Hosts:* Turnip, cabbage.

*Injury:* Is found in connection with injury to roots of these crops, especially where a fungus disease known as "club," "anbury," etc., is present. There is a possibility that the gnat might be concerned in the spread of the fungus.

*Distribution:* England.

ORMEROD, E. A. Sixteenth Rept. Injurious Insects, 1892, pp. 147, 148.

### Athalia spinarum Fabricius.

(Turnip Sawfly. Tenthredinidæ; Hymenoptera.)

*Hosts* Crucifers, turnips, beets, etc.

*Injury:* Defoliates.

*Biology: Eggs* laid in the leaves. *Larvæ* feed on the leaves. Pupates in earthen cocoon.

JABLONOWSKI. Tier. Feinde d. Zuckerrübe, pp. 298–303, fig. 60.

## VIBURNUM.

(*Viburnum* spp. Family Caprifoliaceæ.)

Ornamental shrubs, including the black haw, the snowball, laurustinus, and many other desirable garden plants. They occur in America, Europe, Africa, Asia, and Java.

### IMPORTANT VIBURNUM INSECTS.

#### HEMIPTERA.

**Coccidæ:**

- Armored—
  - * *Aspidiotus* (*Chrysomphalus*) *perseæ* Comstock; Mexico, England (Kew Gardens), Florida.
  - *Aspidiotus spinosus* Comstock; Italy; *Viburnum tinus*.
  - *Chionaspis salicis* Linnæus; Europe.
  - *Parlatoria myrtus* Maskell; South Australia.
  - *Chionapsis* (*Phenacaspis*) *eugeniæ* Maskell; Australia, China, Japan, Ceylon, Hawaii.
- Unarmored—
  - * *Lichtensia viburni* Signoret; France, England, Wales, Massachusetts.
  - *Pseudococcus viburni* Signoret; France, Maritime Alps.
  - *Solenococcus muratæ* Kuwana; Japan.

## WALNUT AND BUTTERNUT.

(*Juglans* spp. Family Juglandaceæ.)

Hardy nut-bearing trees of Europe, Asia, and America. The nuts are all edible. The trees are valuable for shade and the wood is very valuable for furniture. The husks of the nuts are sometimes used for medicinal purposes or for tanning.

### IMPORTANT WALNUT INSECTS.

#### HEMIPTERA.

**Coccidæ.**

Armored—

*Aspidiotus (Diaspidiotus) juglandis* Colvée; Spain; *Juglans regia.*
*Diaspis leperii* Signoret; Europe; *Juglans cinerea, J. regia.*

Unarmored—

*Lecanium coryli* Linnæus; *Juglans nigra, J. regia.*

#### COLEOPTERA.

**Cerambycidæ.**

*Cerambyx cerdo* Linnæus; Europe; bores in wood. (See Oak.)
*Oberea linearis* Linnæus; Europe; bores in pith of nursery stock. (See Hazel.)
*Saperda scalaris* Linnæus; Europe; bores in wood and bark.

**Curculionidæ.**

*Magdalis carbonaria* Linnæus; Europe; bores in trunks. (See Birch.)
*Alcides porrectirostris* Marshall; India; breeds in nuts of *Juglans regia.*

#### LEPIDOPTERA.

**Cossidæ.**

*Cossus cossus* Linnæus; goat moth; Europe; bores in wood. (See Willow.)

**Tortricidæ.**

*Laspeyresia splendana* Hübner; Europe. (See Chestnut.)
*Laspeyresia grossana* Haworth; Europe. (See Beech.)
*Laspeyresia amplana* Hübner; Europe. (See Hazel.)

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
NÜSSLIN, O. Leitfaden der Forstinsektenkunde, 2d ed., 1913.
STEBBING, E. P. Indian Forest Insects, Coleoptera, 1914.

## WATERCRESS.

(*Roripa nasturtium.*)

A hardy market crop grown in moist soil, ditches, and water courses.

### AN IMPORTANT WATERCRESS INSECT.

#### Limnophilus flavicornis Fabricius.

(Watercress Caddis Worm. Limnophilidæ; Trichoptera).

*Hosts:* Water cress, *Lemna.*

*Injury:* The larvæ feed on the leaves.

*Biology:* The larvæ are concealed in cases and live under water. The eggs are laid in gelatinous masses and are sometimes retained for a while at the extremity of the female's body, but are finally attached to some aquatic plant.

*Distribution:* England.

SORAUER, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 236.

## WATERMELON.

See Cucurbits.

## WHEAT; EMMER; SPELT.

(*Triticum sativum* Lam. and *Triticum* spp. Family Gramineæ.)

Wheat is grown in many parts of the world and is a standard article of commerce. The principal manner in which its insect enemies may be transported is in shipments of the grain, although the occasional use of straw in packing would be liable to introduce stem-infesting insects. The greater part of the world's wheat crop is grown in Europe. For full treatment of its insect pests see Grains and grasses.

## WILLOW.

(*Salix* spp. Family Salicaceæ.)

Important trees along waterways in Europe and America. The wood is used in the manufacture of gunpowder and for many other purposes. Certain species are cultivated for materials with which to manufacture baskets.

### A. BETTER KNOWN WILLOW INSECTS LIKELY TO BE IMPORTED.

#### **Crepidodera aurata** Marsh.

(Willow Leaf Beetle. Chrysomelidæ; Coleoptera.)

*Hosts:* Willow, *Populus laurifolia*, *P. alba*.
*Injury:* Feeds on foliage.
*Distribution:* Throughout Europe.

#### **Phyllodecta** spp.

(Willow Leaf Beetles. Chrysomelidæ; Coleoptera.)

*Species: P. vitellinae* Linnæus; Europe, Connecticut (introduced); willows (*Salix purpurea*, etc.), poplar. *P. vulgatissima* Linnæus; Europe; willows (*Salix viminalis*, etc.). *P. tibialis* Suffrian.; Europe; willow.

*Injury:* Feed on foliage in adult and larval stages.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 518.

#### **Cossus cossus** Linnæus.

(Goat Moth. Cossidæ; Lepidoptera.)

*Hosts:* Willow, poplar, alder, elm, oak, birch, linden, walnut, scotch pine, ash, beech, maple.

*Injury:* Bores in trees to the heartwood. Very serious, kills many trees.

*Description and biology.—Adult*, male wing expanse 68–75 mm., female 75–90 mm.; stout and clumsy, clothed with dense gray hairs, forewings dark gray and brown, with dusky transverse streaks; hind wings ashy gray to grayish brown with some indistinct brown marks; antennæ fringed with gray. Occurs June and July and flies at dusk. *Pupa*, rich brown in color, with three rings of spines around abdomen. Pupation occurs in larval galleries; requires about a month. *Larva*, length 75–100 mm., dirty ocher-yellow, with broad, median dorsal, mahogany-red stripe; head blackish brown two deep-brown spots on first thoracic segment. Larval period about 3 years; tunnel in wood, occasionally leave trees. *Eggs*, brown, round, convex above, flattened below, ribbed; deposited in groups of 15 to 50 in crevices of bark; each female deposits 200 to 300 eggs, which hatch in about 10 days. (See text fig. 107.)

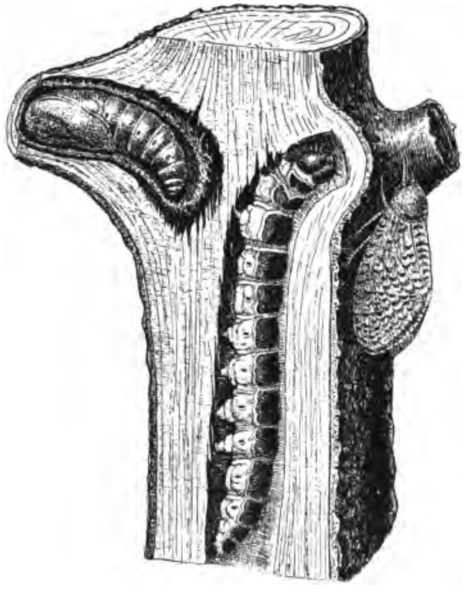


Fig. 107.—The goat moth (*Cossus cossus*): Larva, pupa and adult. (Henschel.)

*Distribution:* Europe, Syria, Korea, North Africa.

Theobald, F. V. Insect Pests of Fruit, 1909, p. 42.
Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, p. 322.
Nüsslin, Otto. Leitfaden der Forstinsektenkunde, 2d ed., 1913, p. 321, fig. 272.

### Rhabdophaga spp.

(Willow Gall Midge. Itonididæ [Cecidomyiidæ]; Diptera.)

*Species: R. nielsonii* Kieffer; Denmark; willow. *R. saliciperda* Dufour; Europe; willow; *Populus alba. R. salicis* Schrk.; Europe; *Salix purpurea.*

*Injury:* Bore in wood and form gall-like formations.

*Description and biology: R. nielsonii* with head and thorax beneath yellowish red, thorax dark brown above; abdomen red; length 3 mm.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3, pp. 456, 457, fig. 277.

## B. OTHER IMPORTANT WILLOW INSECTS.

### ACARINA.

**Eriophyidæ.**

*Eriophyes tetanothrix* Nalepa, blister mite; England; attacks leaves of *Salix caprea.*

### HEMIPTERA.

**Aphididæ.**

*Lachnus viminalis* Fonsc., plant louse; Germany; attacks shoots of *Salix viminalis.*

**Coccidæ.**

Armored—

*Aspidiotus* (*Targionia*) *distincta* Leonardi; Europe.
*Chionaspis salicis* Linnæus; Europe.

Unarmored—

*Lecanium ciliatum* Douglas; Europe.
*Lecanium coryli* Linnæus; Europe.
*Phenacoccus aceris* Signoret; Europe.
*Pulvinaria betulae* Linnæus; Europe.

### COLEOPTERA.

**Anobiidæ.**

*Ptilinus fuscus* Geoffroy; Europe; bores in dead wood of standing living trees.
*Ptilinus pectinicornis* Linnæus; Europe; bores in wood.

**Buprestidæ.**

*Agrilus sexguttatus* Brahm., Europe; bores in bark.
*Poecilonota variolosa* Paykull; Europe; bores in bark.

**Scarabæidæ.**

*Amphimallon solstitialis* Linnæus; Europe; larvæ attack roots of shoots.
*Melolontha hippocastani* Fabricius and *M. melolontha* Linnæus; Europe; larvæ attack roots of seedlings.

**Cerambycidæ.**

*Æolesthes sarta* Solsky; India; bores in trunks of *Salix alba* and *S. babylonica.*
*Aromia moschata* Linnæus; Germany; bores in stems and old cuttings.
*Lamia textor* Linnæus; Europe; bores in larger cuttings and shoots.
*Oberea oculata* Linnæus; Europe; bores in pith of twigs and stems.
*Phymatodes lividus* Rossi; Germany; particularly injurious to baskets; also, attacks felled trees and lumber.
*Saperda carcharias* Linnæus, **S. populnea* Linnæus; Europe; bore in bark and wood. The latter species occurs on the Pacific coast of the United States.

**Chrysomelidæ.**

*Haltica quercetorum* Foudr.; Europe; leaf beetle (see Oak); *H. ampelophaga* Guérin; Europe, Africa (see Grape).
*Melasoma populi* Linnæus; India; defoliator on *Salix elegans* and *S. babylonica.*

**Curculionidæ.**

*Dorytomus affinis* Paykull, *D. agnathus* Boheman, *D. dorsalis* Herbst, *D. maculatus* Marsham, *D. majalis* Paykull; Europe; the eggs are laid in the buds in the fall, and the larvæ develop in the flowers in the spring.
*Orchestes decoratus* Germar; Europe; mines the leaves of *Salix triandra, S. viridis, S. fragilis,* and *S. purpurea.*
*Orchestes populi* Fabricius; Europe; mines the leaves of *Salix viminalis,* and *S. triandra.*
* *Cryptorhynchus lapathi* Linnæus; Europe, eastern United States; breeds in the stems and twigs.

### LEPIDOPTERA.

**Cossidæ.**

*Zeuzera pyrina* Linnæus; Europe; bores in wood of basket willow. (See Horse-chestnut.)

**Cymbidæ.**

*Earias chlorana* Hübner; Europe; attacks foliage, buds, and shoots of long-leaf willows.

**Geometridæ.**

*Anisopteryx æscularia* Schiffermiller; Europe; feeds on foliage.
*Larentia dilutata* Borckh.; Europe; defoliator.

**Lasiocampidæ.**

*Eriogaster lanestris* Linnæus and *Malacosoma neustria* Linnæus; Europe; defoliators.
*Gastropacha quercifolia* Linnæus; Europe. (See Fruit.)

**Lymantriidæ.**

**Euproctis chrysorrhœa* Linnæus, **Lymantria monacha* Linnæus, **Porthetria dispar* Linnæus, **Orgyia antiqua* Linnæus, *Porthesia similis* Fuessly, and *Stilpnotia salicis* Linnæus; Europe; defoliators. (See Forest defoliators.)

**Sesiidæ.**

*Sesia formicaeformis* Esp.; Europe; bores in stems and shoots.

### HYMENOPTERA.

**Cimbicidæ.**

*Cimbex variabilis* Klug; Europe; sawfly, attacks leaves.
*Pseudoclavellaria amerinæ* Linnnæus; a sawfly; Europe; defoliator.
*Trichiosoma lucorum* Linnæus; Europe; defoliator.

**Tenthredinidæ.**

*Euura ater* Jurine, *Pontania salicis* Christ, and *Pteronidea salicis* Linnæus; Europe; sawflies.

### DIPTERA.

**Itonididæ (Cecidomyidæ).**

*Cecidomyia saliciperda* Dufour; Europe; breeds in branches of *Salix triandra*, *S. alba*, *S. fragilis*, *S. caprea*, and *S. purpurea*.
*Cecidomyia salicis* Schrank; Europe; breeds in shoots.

### LITERATURE.

Sorauer, P. Handbuch der Pflanzenkrankheiten, 3d ed., 1913, vol. 3.
Nüsslin, O. Leitfaden der Forstinsektenkunde, 2d ed., 1913.
Hess, R. Der Forstschutz, 1900, vol. 2.
Stebbing, E. P. Indian Forest Insects, Coleoptera, 1914.
Bargagli, P. Rassegna Biologica Rincofori Europei, 1883–87.
Lindinger, B. Die Schildläuse (Coccidæ), 1912.

## YEW.

(*Taxus* spp. Family Taxaceæ.)

Ornamental evergreen trees or shrubs distributed throughout the northern hemisphere. The wood is valued for cabinetmaking. In studying the pests of this genus reference should also be made to Conifers.

### Eriophyes psilaspis Nalepa.

(Yew Gall Mite. Eriophyidæ. Acarina.)

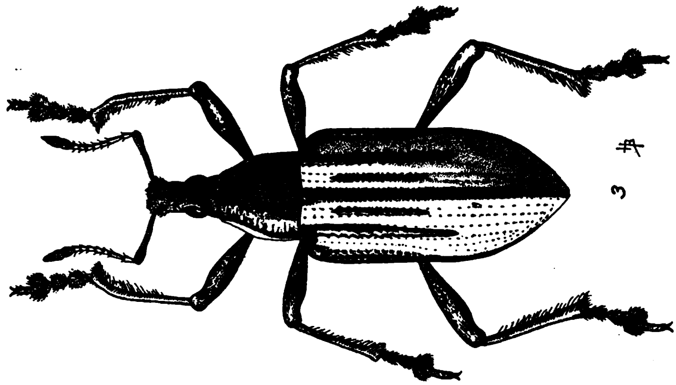
*Host:* Yew.

*Injury:* Forms gall-like swellings of the buds. Serious injury to hedges.

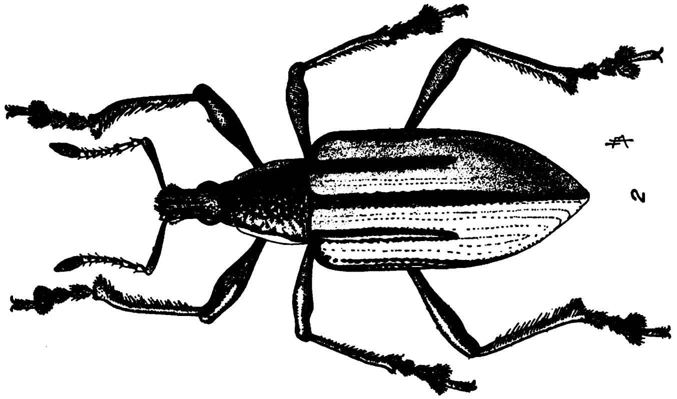
*Description and biology:* Four-legged blister mite, which causes galls by its feeding. Especially liable to introduction on nursery stock.

*Distribution:* England.

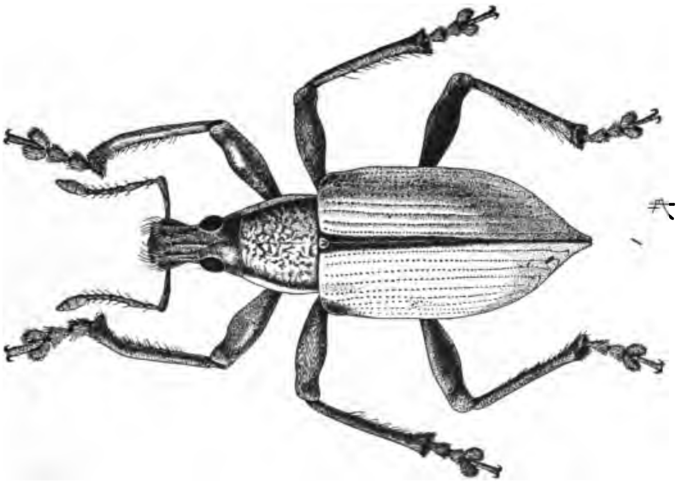
Gillanders, A. T. Forest Entomology, Edinburgh and London, 1908, p. 26, fig. 25.



3 ♀



2 ♀

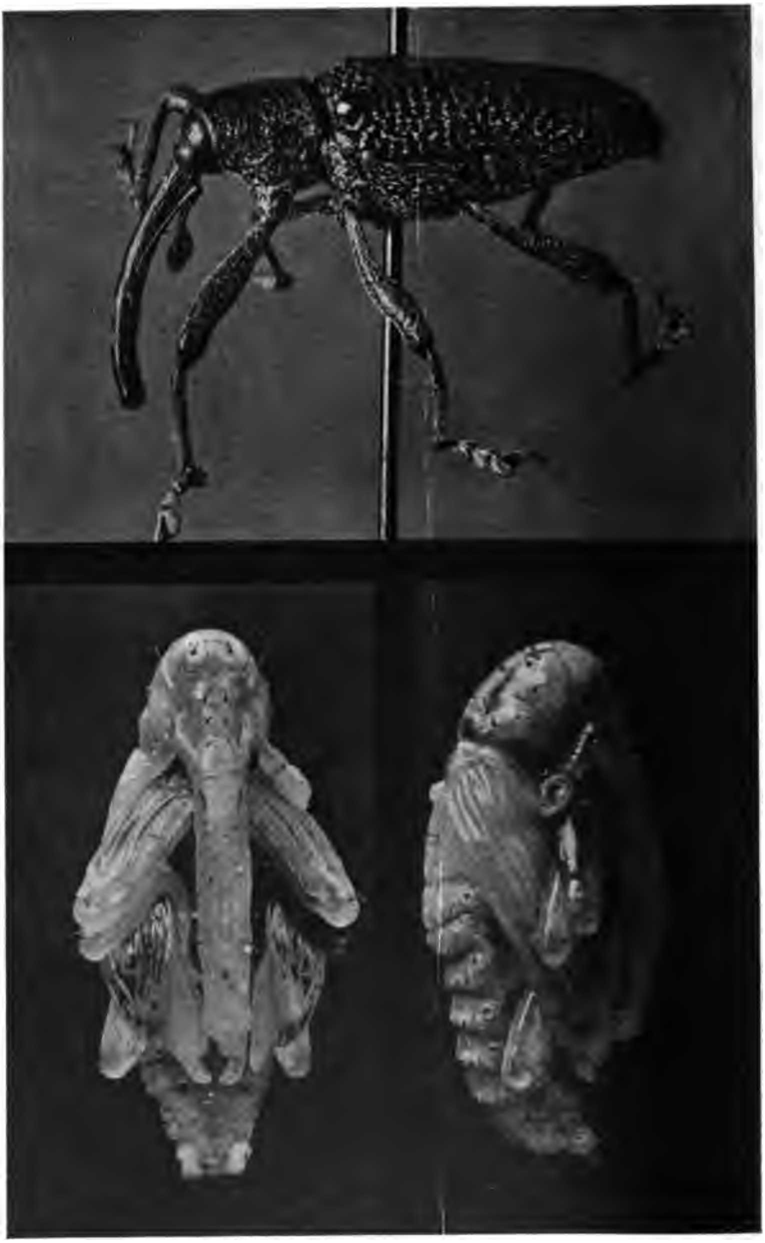


♀

THE WEST INDIAN SUGAR-CANE ROOT WEEVILS.

FIGS. 1, 2, 3.—Varieties of *Diaprepes abbreviatus*. (Pierce.)

UNIV. OF MICH.



THE AVOCADO WEEVIL (HEILIPUS LAURI). (BARBER, PROC. ENT. SOC. WASHINGTON.)

# INSECT INDEX.

Page.

- *Abraxas grossulariata* 119
- *Acanthocinus ædilis* 73
- *Acantholyda erythrocephala* 70
- *Acanthophorus serraticornis* 193
- *Acanthopsyche reidi* 211
  - *snelleni* 211
- *Acanthoscelides obtectus* 6, 36, 165
- Acarina 7
- *Acherontia atropos* 185
- *Acheta bimaculata* 89
- *Acidia heraclei* 52, 164
- *Aclerda distorta* 33
  - *japonica* 33, 206
  - *tokionis* 33
- *Acmæodera stictipennis* 193
- *Acridium æruginosum* 205
  - *flavicorne* 205
  - *hieroglyphicum* 89
  - *luteicorne* 205
  - *migratorium* 215
  - *peregrinum* 89
  - *roseum* 205
  - *succinctum* 205
  - *zehntneri* 205
- *Acridocephala bistriata* 195
- *Acrocinus accentifer* 59
- *Acronycta aceris* 40
- *Adelocera modesta* 212
- *Adoretus umbrosus* 50, 59, 90, 131, 191, 207, 215
  - *tenuimaculatus* 50, 59, 90, 191, 210
- *Adoxus obscurus* 6
- *Ænaria lewisi* 190
- *Æolesthes holosericea* 193, 218
  - *sarta* 96, 171, 181, 222
- *Æolus vittatus* 207
- *Æsiotes notabilis* 195
- *Agelastica alni* 12, 46
- *Agrilus angustulus* 39, 134, 153
  - *betuleti* 73
  - *biguttatus* 39, 153
  - *elongatus* 39, 153
  - *sexguttatus* 181, 222
  - *sinuatus* 5, 169
  - *subauratus* 134, 153
  - *viridis* 12, 39, 46, 73, 131, 141, 148, 150, 181, 192
- *Agriotes aterrimus* 68, 153
  - *formosanus* 207
  - *lineatus* 43, 49, 51, 68, 85, 126, 137, 140, 153, 165, 166, 184, 214
  - *obscurus* 68, 153
  - *pilosus* 214
  - *sacchari* 207
  - *taichuensis* 207
- *Agromyza fabalis* 38
  - *frontalis* 136

Page.

- *Agromyza maura* 28, 29
  - *phaseoli* 37
  - *simplex* 28, 29
- *Agrotis* sp 6
  - *crinigera* 210
  - *dislocata* 210
  - *exclamationis* 44
  - *interjectionis* 208
  - *plecta* 44
  - *saucia* 210
  - *segetum* 44, 70, 216
  - *spina* 185
  - *tritici* 75
  - *trux* 216
  - *vestigialis* 70
  - *ypsilon* 8, 14
- *Akermes levis* 9
  - *punctatus* 59
  - *scrobiculatus* 9
- *Alaus sculptus* 193
- *Alcides porrectirostris* 220
  - *scenicus* 103
- Alder bud moth (see *Coleophora fuscedinella*).
- *Aleurocanthus woglumi* 56
- *Aleurodicus cocois* 34, 109, 132, 139
  - *destructor* 159
- *Aleurolobus longicornis* 207
  - *olivinus* 155
- *Aleurothrixus porteri* 56
- *Aleyrodes* spp 213
  - *lactea* 207
  - *tabaci* 213
- Aleyrodidæ 7
- Alfalfa gall midge (see *Asphondylia miki*).
  - leaf weevil (see *Hypera murina*).
  - weevil of Europe (see *Hypera postica*).
- *Aloha ipomϾ* 210
- Amar caterpillar (see *Virachola isocrates*).
- *Amatissa consorta* 211
- Ambrosia beetles (see *Anisandrus* spp.; *Xyloterus* spp.).
- *Amorbia emigratella* 210
- *Amphimallon solstitialis* 39, 73, 137, 181, 222
- *Amsacta lactinea* 216, 217
  - *lineola* 216
  - *moorei* 216
- *Anagnia splendens* 206
- *Anastrepha acidusa* (see *Anastrepha fraterculus*).
  - *fraterculus* 60, 64, 94, 100, 113, 132, 147, 164, 170, 180
  - *ludens* 60, 114, 132, 167, 180, 194
  - *peruviana* 114
  - *serpentina* 132
- *Anaxiphus pallidulus* 205

Page.

- *Andraca bipunctata* .......... 212
- *Anerastia ablutella* .......... 208
  - *botella* .......... 126
- Angoumois grain moth (see *Sitotroga cerealella*).
- *Anisandrus dispar*. 12, 40, 46, 54, 137, 138, 148, 154, 171
- *Anisolabris maritima* .......... 215
- *Anisopteryx æscularia* .......... 12, 24, 46, 105, 134, 138, 154, 170, 179, 192, 223
- Annona fruit fly (see *Ceratitis anonæ*).
- *Anomala ænea* .......... 46, 207
  - *grandis* .......... 12
  - *vitis* .......... 127, 190
- *Anomalococcus cremastogastri* .......... 102
- *Anonæpestis bengalella* .......... 93
- *Anoplus plantaris* .......... 46
- *Antharia osmastoni* .......... 73
  - *quadripunctata* .......... 68
- *Anthomyia radicum* .......... 50, 187
- *Anthonomus druparum* .......... 179
  - *grandis* .......... 87
  - *incurvus* .......... 23
  - *pedicularius* .......... 23, 170
  - *pomorum* .......... 18, 170
  - *pyri* .......... 23, 170
  - *rectirostris* .......... 174
  - *rubi* .......... 47, 197
  - *spinotus* .......... 170
  - *vestitus* .......... 87
- *Anthores asperula* .......... 63
- *Anticyra combusta* .......... 208
- *Antonina crawii* .......... 33
  - *socialis* .......... 33
- *Aonidia* (see *Aspidiotus* [*Aonidia*]).
- *Aonidiella* (see *Aspidiotus* [*Aonidiella*]).
- *Apate molle* .......... 67
  - *monachus* .......... 30, 56, 63, 166, 179
- *Aphanistichus consanguineus* .......... 199
- *Aphrastasia pectinatæ* .......... 67
- *Aphis avenæ* .......... 5
  - *brassicæ* .......... 5
  - *gossypii* .......... 5
  - *rumicis* .......... 5, 43
- *Apiomorpha attenuata* .......... 98
  - *bäuerleni* .......... 98
  - *calycina* .......... 98
  - *conica* .......... 98
  - *duplex* .......... 98
  - *ellipsoidalis* .......... 98
  - *floralis* .......... 98
  - *helmsii* .......... 98
  - *karschi* .......... 98
  - *maliformis* .......... 98
  - *minor* .......... 98
  - *munita* .......... 99
  - *ovicola* .......... 99
  - *ovicoloides* .......... 99
  - *pedunculata* .......... 99
  - *pharetrata* .......... 99
  - *pileata* .......... 99
  - *pomiformis* .......... 99
  - *rugosa* .......... 99
  - *sessilis* .......... 99
  - *sloanei* .......... 99
  - *strombylosa* .......... 99
  - *thorntoni* .......... 99
  - *umbellata* .......... 99

Page.

- *Apiomorpha urnalis* .......... 99
  - *variabilis* .......... 99
- *Apion armipes* .......... 87
  - *meliloti* .......... 14
  - *tenue* .......... 14
  - *xanthostylum* .......... 87
- *Apoderus coryli* .......... 12, 39, 46
- *Apogonia destructor* .......... 199
  - *ritsemæ* .......... 199
- Apple blossom weevil (see *Anthonomus pomorum*).
  - borer (see *Cossus tristis*).
  - clearwing (see *Sesia myopæformis*).
  - ermine moth (see *Hyponomeuta malinellus*).
  - gum borer (see *Bimia femoralis*).
  - moth (see *Argyresthia conjugella*).
  - pith moth (see *Blastodacna putripennella*).
  - psylla (see *Psylla mali*).
  - root borer (see *Leptops hopei*).
  - sawfly (see *Hoplocampa testudinea*).
  - stem piercer (see *Magdalis barbicornis*).
  - tree borer (see *Rhizopertha collaris*).
- Apricot scale (see *Epidiaspis pyricola*).
- *Apriona cinerea* .......... 150
  - *germari* .......... 150
- *Aradus cinnamomeus* .......... 73
- *Aræcerus fasciculatus* .......... 6, 55, 84, 91
- *Arge rosæ* .......... 192
- Argentine potato weevil (see *Rhigopsidius tucumanus*).
- *Argyresthia conjugella* .......... 6, 20, 149, 180
  - *ephippella* .......... 134, 175
  - *fundella* .......... 70
  - *illuminatella* .......... 82
  - *lævigatella* .......... 83, 84
  - *nitidella* .......... 132, 175
- *Argyroploce illepida* .......... 11
- Army worm (see *Cirphis unipuncta*).
- Army worms .......... 8
- *Aroa socrus* .......... 208
- *Aromia moschata* .......... 222
- *Ascelis attenuata* .......... 99
  - *echiniformis* .......... 99
  - *præmollis* .......... 99
  - *schraderi* .......... 99
- Ash gall mite (see *Eriophyes fraxini*).
- *Asiphum tremulæ* .......... 181
- Asparagus fly (see *Platyparæa pœciloptera*).
  - leaf beetles (see *Crioceris* spp.).
  - miners (see *Agromyza* spp.).
- *Asphondylia miki* .......... 15, 16
- *Aspidiotus alatus* .......... 98
  - *britannicus* .......... 5, 35
  - *camelliæ* .......... 5
  - *confusus* .......... 98
  - *destructor* .......... 163
  - *fissidens pluridentatus* .......... 162
  - *maderensis* .......... 139
  - *minimus* .......... 152
  - *pangoensis* .......... 162
  - *pectinatus* .......... 169
  - *perniciosus* .......... 5
  - *persearum* .......... 30
  - *rapax* (see *A. camelliæ*).
  - *spinosus* .......... 162, 219

Page.

- *Aspidiotus tasmaniæ* 9, 98
  - *tayabanus* 192
  - *varians* 162
- *Aspidiotus* (*Aonidia*) *ebeni* 170
  - *lauri* 35, 72, 169
  - *oleæ* 156
  - *planchonioides* 102
  - *pinicola* 72
- *Aspidiotus* (*Aonidiella*) *cocotiphagus* 102
  - *miniatæ* 98
  - *subcuticularis* 102
  - *subrubescens* 58
- *Aspidiotus* (*Chrysomphalus*) *albopictus* 58
  - *alienus* 44, 158
  - *ansei* 162
  - *dictyospermi* 5
    - *pinnulifera* 58
  - *kœbelei* 58
  - *nigropunctatus* 26, 156
  - *paulistus* 35
  - *pedroniformis* 130
  - *perseæ* 5, 30, 158, 162, 219
  - *personatus* 30, 58, 93, 102, 145, 156, 162
  - *portoricensis* 158
  - *propsimus* 162
  - *scutiformis* 30, 35, 59, 162
- *Aspidiotus* (*Diaspidiotus*) *africanus* 23, 24, 102, 169, 186
  - *coloratus* 158
  - *juglandis* 220
  - *orientalis* 5, 59, 162
  - *ostreæformis* 5, 166, 169
  - *patavinus* 178
  - *pyri* 132, 169
  - *zonatus* 152
- *Aspidiotus* (*Evaspidiotus*) *labiatarum* 130
- *Aspidiotus* (*Hemiberlesia*) *palmæ* 162
  - *simillimus* 162
- *Aspidiotus* (*Morganella*) *longispina* 145
  - *maskelli* 102, 146
- *Aspidiotus* (*Odonaspis*) *bambusarum* 32
  - *canaliculata* 32
  - *inusitata* 32
  - *secreta* 32
  - *saccharicaulis* 32, 206
- *Aspidiotus* (*Pseudaonidia*) *articulatus* 30, 59, 63, 102, 130, 131, 146, 156, 158, 162, 192
  - *clavigera* 59, 102, 146, 166
  - *duplex* 59, 156
  - *fimbriatus* 59
  - *fossor* 130
  - *obsita* 102
  - *quadriareolata* 9
  - *silvatica* 102
  - *tesserata* 130
  - *trilobitiformis* 59, 102, 131, 146, 162
- *Aspidiotus* (*Pseudischnaspis*) *bowreyi* 192
  - *linearis* 162
  - *longissima* 146
- *Aspidiotus* (*Targionia*) *acaciæ* 9
  - *alni* 11, 152
  - *biformis* 5, 158
  - *cattleyæ* 158
- *Aspidiotus* (*Targionia*) *bromeliæ* 171
  - *distincta* 152, 222
  - *glomerata* 206
  - *sacchari* 206
  - *vitis* 130, 152
- *Aspidomorpha militaris* 210
  - *sanctæcrucis* 212
- *Aspidoproctus giganteus* 194
- *Asterolecanium aureum* 158
  - *bambusæ* 33, 206
  - *bambusicola* 33
  - *ceriferum* 162
  - *coffeæ* 63
  - *coronatum* 33
  - *epidendri* 158
  - *exiguum* 33
  - *flavociliatum* 33
  - *hemisphæricum* 33
  - *hilli* 162
  - *lanceolatum* 33
  - *lineare* 162
  - *masuii* 33
  - *miliaris* 33
  - *palmæ* 162
  - *pudibundum* 33
  - *pustulans* 102
  - *rubrocomatum* 33
  - *solenophoroides* 33
  - *tenuissimum* 33
  - *tumidum* 33
  - *udagamæ* 33
  - *urichi* 162
  - *variolosum* 5, 153
  - *ventruosum* 9
- *Asthenia pygmæana* 70
- *Astycus lateralis* 212
- *Athalia spinarum* 44, 219
- *Athous hirtus* 79
  - *niger* 43, 214
  - *subfuscus* 39, 134, 137, 153
- *Atomaria linearis* 41
- *Atractomorpha bedeli* 205
  - *crenulata* 205, 215
  - *psittacina* 205
- *Aulacaspis cinnamomi* 146
  - *javanensis* 32
  - *miranda* 93
- *Aulacophora olivierei* 92, 166
- Austrian alfalfa leaf weevil (see *Hypera meles*).
- *Autosticha pelodes* 208
- Avocado weevil (see *Heilipus lauri*).
- *Bactrocera cucurbitæ* 24, 25, 38
  - *tryoni* 24, 25, 34, 38, 60, 93, 114, 142, 147, 167, 187
  - *zonatus* 147
- *Balaninus* (See *Curculio*).
- Bamboo borer (see *Dinoderus distinctus; Eucosoma paragramma.*)
  - fruit fly (see *Ceratitis striata*).
  - shot-hole borer (see *Dinoderus pilifrons*).
- Banana fruit fly (see *Dacus curvipennis*).
  - root borer (see *Cosmopolites sordidus*).
- Banded pumpkin beetle (see *Aulacophora olivierei*).
- *Baræus sordidus* 63
- *Baris chlorizans* 49

Page.

- *Baris cœrulescens*, 49
  - *glabra*, 49
  - *lepidii*, 49
  - *opiparis*, 49
  - *saccharivora*, 207
  - *trægardhi*, 92
  - *viridisericea*, 49
- Bark beetles, 8
  - borer (see *Leptostylus præmorsus*).
  - Tortrix (see *Laspeyresia wœberiana*).
- *Barynotus squamosus*, 49
- *Basilianus cantori*, 46
- *Batocera albofasciata*, 103
  - *boisduvali*, 101
  - *frenchi*, 103
  - *rubra*, 103
  - *titana*, 146, 147
- *Bathyscia wollastoni*, 184
- Bean aphis (see *Aphis rumicis*).
  - fly (see *Agromyza phaseoli*).
  - leaf beetle (see *Cerotoma denticornis*).
    - roller (see *Eudamus proteus*).
  - pod borer (see *Maruca testulalis*).
  - stem maggot (see *Agromyza fabalis*).
  - weevils, 8
  - weevil (see *Acanthoscelides* spp.; *Mylabris* spp.; *Pachymerus* spp.)
- *Bedellia minor*, 210
  - *orchilella*, 210
  - *somnulentella*, 210
- Beech tortricid (see *Peronea ferrugana*).
  - tortrix (see *Laspeyresia grossana*).
- Beet army worm (see *Laphygma exigua*).
  - carrion beetle (see *Blitophaga opaca*).
  - fly or Spinach leaf miner (see *Pegomya hyoscyami*).
  - root weevil (see *Cleonus punctiventris*).
  - tortoise beetle (see *Cassida nebulosa*).
  - worm (see *Plusia gamma*).
- *Belippe albiguttata*, 212
- *Bemisia giffardi*, 56
- *Bembecia hylæiformis*, 47
- Bibitkever (see *Entochira lateralis*).
- *Bimia femoralis*, 98
- Birch blister mite (see *Eriophyes rudis*).
  - twig weevil (see *Magdalis carbonaria*).
- *Biston hirtarius*, 110, 111, 179
  - *pomonarius*, 110, 154
  - *suppressarius*, 10, 211
- *Bixadus sierricola*, 63
- Black alfalfa leaf beetle (see *Colaspidema atrum*).
  - scale (see *Saissetia oleae*).
- *Blaps armata*, 73
  - *mucronata*, 216
- *Blastodacna hellerella*, 20
  - *putripenella*, 19
  - *vinolentella*, 19
- Blister beetle (see *Epicauta rufidorsum*).
- *Blitophaga opaca*, 5, 43
  - *undata*, 43
- Blue or hairstreak butterfly (see *Lycæna bætica*).
- *Boarmia crepuscularia*, 55, 96
  - *gemmaria*, 129, 192
  - *selanaria*, 194

Page.

- Boll worms (see *Diparopsis castanea*; *Earias* spp.; *Sacadodes pyralis*).
- *Bostrychopsis jesuita*, 59
  - *parallela*, 33
- *Bostrychus capucinus*, 53, 153
- *Bothynoderes farinosus*, 44
  - *punctiventris*, 44
- *Botys cœlesalis*, 208
- *Brachonyx pineti*, 74
- *Brachycerus albidentatus*, 158
  - *corrosus*, 158
  - *pradieri*, 158
  - *undatus*, 158
- *Brachyderes incanus*, 46
  - *lusitanicus*, 154
- *Brachyrhinus* (*Otiorhynchus* spp.), 65, 128
  - *armadillo*, 65
  - *armatus*, 129
  - *asphaltinus*, 129
  - *aurifer*, 65
  - *corruptor*, 129, 167
  - *egregius*, 65
  - *fullo*, 65
  - *fuscipes*, 65
  - *globus*, 129
  - *inflatus*, 65
  - *irritans*, 65
  - *jovis*, 65
  - *kratterii*, 65
  - *lævigatus*, 173
  - *lepidopterus*, 65
  - *ligustici*, 44, 129, 167
  - *morio*, 65
  - *multipunctatus*, 65
  - *niger*, 65
  - *orbicularis*, 44
  - *ovatus*, 6, 65
  - *perdix*, 65
  - *picipes*, 197
  - *populeti*, 129
  - *raucus*, 44, 129
  - *sensitivus*, 65
  - *septentrionis*, 65
  - *singularis*, 65, 129
  - *sulcatus*, 6, 129
  - *tenebricosus*, 47, 197
  - *teretirostris*, 129
  - *tristis*, 129
  - *turca*, 129
- *Brachytrypes achatinus*, 14, 215
- *Brachyxystus subsignatus*, 52, 68
- Brazil fig borer (see *Heilipus bonelli*).
- Broad-nosed grain weevil (see *Caulophilus latinasus*).
- *Bromius obscurus*, 127
  - *vitis*, 127
- *Brontispa froggatti*, 160
- Broun's fruit fly (see *Dacus* [*Tephrites*] *xanthodes*).
- Brown hard-back beetle (see *Phytalus smithi*).
  - plum owlet moth (see *Xylina socia*).
- Brown-tail moth (see *Euproctis chrysorrhœa*).
- Bruchus (see *Mylabris* spp.).
- Brush spinner (see *Orgyia gonostigma*).
- *Bryobia ribis*, 119
- Bud stinger (see *Janus compressus*).

Page.
Buff tip moth (see *Phalera bucephala*).
*Bupalus piniarius* 66
*Buprestis geometrica* 73
*Byctiscus betulæ* 12, 39, 46
*Byturus tomentosus* 47
Cabbage aphis (see *Aphis brassicæ*).
  gall midge (see *Dasyneura brassicæ*).
  maggot (see *Phaonia trimaculata*).
  midge (see *Contarinia torquens*).
  webworm (see *Hellula undalis*).
  worm (see *Pieris monuste*).
Cacao fruit fly (see *Ceratitis punctata*).
  moth (see *Zaratha cramerella*).
Cadelle (see *Tenebrioides mauritanicus*).
*Calamistis fusca* 85
*Calamobius marginellus* 126
*Calathus fuscipes* 81
*Calendra granaria* 6
  *linearis* 210
  *oryza* 6
  *rugicollis* 210
  *sculpturata* 154
California grape rootworm (see *Adoxus obscurus*).
*Caliroa æthiops* 6
*Callidium æneum* 39, 54, 153
  *violaceum* 39
*Calocampa exoleta* 44
*Calocoris fulvomaculatus* 136
*Caloptenus italicus* 215
*Camarimena rugosistriatus* 52
*Camarota flavitarsis* 125
*Camponotus ligniperda* 11
Cane grasshopper (see *Atractomorpha crenulata*).
  leafhopper (see *Pyrilla aberrans*).
  root borer (see *Polyocha saccharella*).
  sucker moth (see *Castnia licus*).
*Cantharis fusca* 73
*Capnodis indica* 73
  *miliaris* 181
  *tenebrionis* 110, 179
*Capua angustiorana* 24, 131, 170
*Caradrina exigua* (see *Laphygma*).
*Cardiococcus umbonatus* 131
*Cardiophorus devastans* 207
  *formosanus* 207
*Carphoborus minimus* 74
*Carpocapsa* (see *Laspeyresia*).
*Carpomyia pardalina* 93
*Caryoborus gonagra* 149, 210
*Cassida nebulosa* 6, 41, 158
  *vittata* 44
Castilloa borer (see *Inesida leprosa*).
*Castnia licus* 34, 159, 202
Catalpa scale (see *Diaspis pentagona*).
*Catorama tabaci* 214
*Caulophilus latinasus* 6, 30
*Cecidomyia humuli* 135
  *saliciperda* 223
  *salicis* 223
Celery fly (see *Acidia heraclei*).
  leaf tyer (see *Phlyctænia ferrugalis*).
*Ceocephalus carus* 218
*Cephaleia hypotrophica* 70
  *signata* 70
*Cephus pygmæus* 126
*Cerambyx cerdo* 26, 151, 153, 220
Page.
*Cerambyx miles* 131
  *scopolii* 23, 169
*Ceratitis anonæ* 51, 94, 115, 132
  *capitata* 24, 25, 30, 34, 38, 60, 64, 93, 94, 100, 103, 115, 116, 126, 131, 132, 133, 140, 142, 147, 163, 167, 170, 171, 180, 186, 187, 194, 217, 218
  *catoirei* 58
  *giffardi* 116, 139
  *nigerrima* 116
  *punctata* 51, 116, 126, 132, 147
  *rubivora* 116
  *silvestrii* 116, 139
  *striata* 32
*Ceratopachys variabilis* 148
*Cerococcus ornatus* 63
*Ceronema caudata* 99
*Ceroplastes actiniformis* 162
  *campinensis* 131
  *ceriferus* 63, 102
  *cistudiformis* 30
  *denudatus* 94
  *erithræus* 9
  *ficus* 102
  *gowdeyi* 102
  *grandis* 131
  *mimosæ* 9
  *myricæ* 102, 162
  *psidii* 131
  *quadrilineatus* 94, 102
  *rubens* 30, 102, 146, 162, 169, 170
  *rusci* 102, 132, 150, 156, 171, 181
  *singularis* 131
  *theobromæ* 33
  *townsendi percrassus* 102
  *vinsonii* 131, 142, 146
  *vinsonioides* 63
*Ceroputo yuccæ* 94, 102
*Cerostoma parenthesella* 40
*Cerotoma denticornis* 38
*Cetonia lugubris* 216
*Ceutorhynchus assimilis* 187, 188
  *contractus* 92
  *cyanipennis* 49
  *quadridens* 49, 188
  *raphani* 187
  *robertii* 187
  *sulcicollis* 49, 188
*Chætocnema basalis* 191
  *concinna* 189
  *tibialis* 44
*Chætococcus bambusæ* 33
*Chætosticha nana* 208
*Chalcoides chloris* 44
*Charagia lignivora* 10, 20, 100
Charlock weevil (see *Ceutorhynchus contractus*).
*Cheimatobia boreata* 40, 46, 179
  *brumata* 24, 105, 148, 154, 179
*Chermes abietis* 67
  *viridis* 67
Cherry borer (see *Cryptophaga unipunctata*).
  bug (see *Peltophora pedicillata*).
  ermine moth (see *Hyponomeuta padellus*).
  fruit moth (see *Argyresthia nitidella*).
  green beetle (see *Diphucephala colaspidoides*).
  spinner (see *Biston hirtarius*).

Page.

- Cherry tree case-bearer (see *Coleophora anatipennella*).
  - weevil (see *Curculio cerasorum*).
- Chestnut weevil (see *Curculio elephas*).
- *Chilo auricilia* ... 85, 189, 196, 208
  - *infuscatella* ... 208
  - *simplex* ... 85, 126, 191, 196, 203
- *Chionaspis arundinariæ* ... 32
  - *austriaca* ... 72
  - *bambusæ* ... 32
  - *berlesei* ... 29
  - *colemani* ... 32
  - *depressa* ... 206
  - *elongata* ... 32
  - *frenchi* ... 98
  - *graminis* ... 32
  - *hikosani* ... 32
  - *inday* ... 162
  - *madiunensis* ... 206
  - *manni* ... 102
  - *nerii* ... 156
  - *saccharifolii* ... 206
  - *salicis* ... 11, 26, 45, 48, 95, 121, 141, 147, 152, 181, 219, 222
  - *samoana* ... 162
  - *simplex* ... 32
  - *striata* ... 25, 94, 139
  - *substriata* ... 162
  - *tegalensis* ... 206
  - *vitis* ... 130, 146
- *Chionaspis* (*Phenacaspis*) *bupleuri* ... 156
  - *cockerelli* ... 162
  - *dilatata* ... 146, 162
  - *eugeniæ* ... 146, 219
  - *megaloba* ... 131
  - *natalensis* ... 146
- *Chloridea assulta* ... 216
  - *obsoleta* ... 6, 14
  - *peltigera* ... 216
- *Chloroclystis rectangulata* ... 20
- *Chlorops lineata* ... 126
  - *tæniopus* ... 125
- *Cholus cattleyæ* ... 159
  - *forbesi* ... 159
- *Chortophila cilicrura* ... 29, 157
- *Chortophila* (*Pegomya*) *brassicae* ... 7
  - *cepetorum* ... 7
  - *fusciceps* ... 7, 38, 50
  - *hyoscyami* ... 7, 42, 158, 196
- *Chramesus globulus* ... 154
- *Chrotogonus trachypterus* ... 14, 89, 215
- *Chrysobothris affinis* ... 153
  - *indica* ... 218
  - *sexnotata* ... 193
  - *solieri* ... 73
- *Chrysochroa bicolor* ... 50
  - *fulminans* ... 50
- *Chrysolophus spectabilis* ... 10
- *Chrysomphalus* [see *Aspidiotus* (*Chrysomphalus*)].
- *Cicadula fasciifrons* ... 190, 206
  - *6-notata* ... 190, 206
- Cigarette beetle (see *Lasioderma serricorne*).
- *Cimbex fagi* ... 40
  - *variabilis* ... 13, 47, 182, 223
- Cinnabar moth (see *Euchelia jacobeæ*).

Page.

- *Cionus fraxini* ... 27, 157
  - *scrophulariæ* ... 44
- *Cirphis leucosticha* ... 85
  - *unipuncta* (*Heliophila, Leucania*) ... 8, 208
- Citrus leaf miner (see *Phyllocnistis citrella*).
- *Cladius pectinicornis* ... 6
- *Clania crameri* ... 55, 64, 76, 211
  - *holmesi* ... 211
  - *variegata* ... 55, 64, 211
- *Cleonus cinereus* ... 44
  - *fasciatus* ... 44
  - *mendicus* ... 44
  - *pedestris* ... 44
  - *piger* ... 44
  - *punctiventris* ... 41, 216
  - *tigrinus* ... 44
  - *ucrainiensis* ... 44
- *Cletus bipunctatus* ... 207
  - *trigonus* ... 207
- *Clinodiplosis equestris* ... 123, 124
  - *mosellana* ... 123, 126
- Clover leaf weevils (see *Hypera* spp.).
  - root weevils (see *Sitona* spp.).
- *Clysia ambiguella* ... 129, 130
- *Clytus floralis* ... 14
  - *tropicus* ... 153
- *Cnaphalocrocis bifurcalis* ... 208
- *Cnaphalodes lapponicus* ... 67
  - *strobilobius* ... 67
- *Cneorhinus albiguttatus* ... 207
  - *plagiatus* ... 29, 51
- *Cnethocampa pinivora* ... 71, 76
  - *pityocampa* ... 71, 76
  - *processiona* ... 152
- Coccidae ... 7
- *Coccotrypes integer* ... 193
- *Coccus acuminatus* ... 35, 131, 146, 158
  - *acutissimus* ... 44, 146, 162
  - *arundinariæ* ... 33
  - *bicruciatus* ... 170
  - *hesperidum* ... 59, 162, 212
  - *hoferi* ... 23
  - *mangiferæ* ... 5, 146
  - *manniparus* ... 211
  - *marsupialis* ... 94
  - *minimus* ... 44, 158
  - *viridis* ... 59, 63, 131, 212
- Cochylis (see *Clysia ambiguella*).
- Cockchafer (see *Melolontha melolontha*).
- Coconut leaf-miner beetles (see *Promecotheca* spp.).
  - leaf moth (see *Levuana iridescens*).
  - palm scale [see *Aspidiotus* (*Chrysomphalus*) *perseæ*].
  - white fly (see *Aleurodicus* spp.).
- Codling moth (see *Laspeyresia pomonella*).
- *Cœlosterna scabrata* ... 193
  - *spinator* ... 10
- *Cœlostomidia assimilis* ... 39
  - *pilosa* ... 39
- *Coepophagus* [see *Rhizoglyphus* (*Coepophagus*)].
- Coffee beetle (see *Xyleborus coffeæ*).
  - bean weevil (see *Aræcerus fasciculatus*).
  - leaf miner (see *Leucoptera coffeella*).
  - red spider (see *Tetranychus bioculatus*).

Page.
*Colabathristes saccharicida* 207
*Colaspidea metallica* 207
*Colaspidema atrum* 13
*Coleophora anatipennella* 24, 175
  *fuscedinella* 11
  *laricella* 82
  *lutipennella* 152
*Colobogaster quadridentata* 100
*Colopha compressa* 95
*Conarthrus affinis* 33
  *jansoni* 193
*Conchaspis angræci* 5, 102
*Conchylis epilinana* (see *Phalonia*).
*Conchyloctenia punctata* 210
Confused flour beetle (see *Tribolium confusum*).
*Coniatus lætus* 211
  *suavis* 211
Coniferous root weevils (see *Brachyrhinus*).
  sawfly (see *Diprion simile*).
  weevils (see *Magdalis* spp.).
*Conogethes punctiferalis* 166
*Contarinia gossypii* 89
  *pisi* 165
  *pyrivora* 7, 170
  *torquens* 49
  *tritici* 7, 123
  *viticola* 131
*Coptops bidens* 63
  *fusca* 63
*Coptosoma cribraria* 207
*Coptotermes gestroi* 164
*Coræbus elatus* 153
  *fasciatus* 153
  *undatus* 153
Corn fly (see *Siphonella pumilionis*).
Corner spot (see *Orgyia gonostigma*).
*Corymbites æneus* 43
*Cosmophila sabulifera* 155
*Cosmopolites sordidus* 34, 207
*Cosmopteryx pallifasciella* 208
*Cossus cadambe* 212
  *cossus* 12, 27, 40, 46, 96, 141, 148, 154, 181, 220, 221
  *tristis* 19, 170, 187
Cotton blister mite (see *Eriophyes gossypii*).
  boll worm (see *Chloridea obsoleta*).
  flower bud maggot (see *Contarinia gossypii*).
  stainers (see *Dysdercus* spp.).
  stem borer (see *Sphenoptera neglecta*).
  worm (*Prodenia litura*).
*Cratopus punctum* 64
*Cratosomus reidi* 60
*Crepidodera costatipennis* 50
  *aurata* 181, 221
*Criocephalus tibetanus* (?) 73
*Crioceris* spp 27
  *asparagi* 6, 27
  *duodecimpunctata* 6, 27, 28
  *impressa* 103
  *merdigera* 28
*Crœsus septentrionalis* (see *Nematus*).
*Crossotarsus coniferæ* 52, 81
  *fairmairei* 75, 154
  *saundersi* 194
Crucifer leaf beetles (see *Phyllotreta* spp.).
*Cryphalus abietis* 69
  *boswelliæ* 69
  *deodara* 52
  *himalayensis* 52
  *intermedius* 84
  *longifolia* 74
  *major* 74
  *morinda* 81
  *piceæ* 69
  *saltuarius* 69
  *strohmeyeri* 79
*Crypsiphona occultaria* 99
*Cryptaspidiotus aonidioides* 35
  *mediterraneus* 139
*Cryptaspidus nucum* 162
*Cryptes baccatus* 9
*Crypthemichionaspis africana* 181
*Cryptinglisia lounsburyi* 130
*Cryptoblabes aliena* 208
  *gnidiella* 91, 129, 180
*Cryptocephalus pini* 73
*Cryptococcus fagi* 39
*Cryptophaga rubriginosa* 11
  *unipunctata* 167, 177, 179
*Cryptorhynchus batatæ* (see *Euscepes*).
  *brandisi* 74
  *gravis* (see *Sternochetus*).
  *lapathi* 6, 12, 46, 181, 222
  *mangiferæ* (see *Sternochetus*).
  *raja* 74
*Crypturgus cinereus* 74
  *pusillus* 69
*Ctenochiton araucariæ* 25
  *eucalypti* 99
*Curculio* spp 154
  *amoenus* 103
  *cerasorum* 174
  *elephas* 53
  *herbsti* 179
  *nucum* 133, 134, 154
  *rubidus* 179
Cucurbit fly (see *Dacus cucurbitæ*).
  ladybird beetles (see *Epilachna* spp.).
Currant fruit moth (see *Notocelia roborana*).
  gall mite (see *Eriophyes ribis*).
  moth (see *Abraxas grossulariata*).
  shoot borer (see *Incurvaria capitella*).
  webworm (see *Thamnonoma wauaria*).
  worm (see *Pteronidea ribesii*).
Custard-apple caterpillar (see *Anonæpestis bengalella*).
Cutworms 8
Cutworms (see *Agrotis* spp.; *Euxoa* spp.; *Feltia* spp.; *Peridroma* spp.).
*Cylas brunneus* 209
  *formicarius* 6, 209
*Cyllo leda* 208
*Cymnus tabaci* 207, 215
Cypress borers (see *Diadoxus* spp.).
*Cyrtepistomus pannosus* 212
*Cyrtotrachelus dux* 33
  *longipes* 33
*Cytorhynchus frigidus* 146
*Dactylopius coccus* 162

Page.
*Dacus æqualis* .......... 58
*cucurbitæ* .......... 38, 93, 217
*curvipennis* .......... 34
*diversus* .......... 60, 117, 132, 147, 167
*ferrugineus* .......... 60, 93, 100, 117, 147
*frenchii* .......... 117
*oleæ* .......... 156
*ornatissimus* .......... 58
*passifloræ* .......... 60, 117, 126, 147
*persicæ* .......... 117, 147, 167
*psidii* .......... 118, 126, 132
*rarotongæ* .......... 145
*tongensis* .......... 145
(*Tephrites*) *xanthodes* .... 118, 126, 132, 142, 171
*Dasychira horsfeldi* .......... 194
*mendosa* .......... 64, 212
*misana* .......... 64, 212
*pudibunda* .......... 12, 40,
47, 48, 107, 132, 134, 137, 141, 148, 154, 192
*selenitica* .......... 66
*thwaitesi* .......... 64, 212
*Dasyneura abietiperda* .......... 81
*brassicæ* .......... 49, 188
*laricis* .......... 84
*piceæ* .......... 81
*pyri* .......... 168
Death's-head moth (see *Acherontia atropos*).
*Delphacodes vastatrix* .......... 206
*Delphax fumosa* .......... 206
*furcifera* .......... 190, 206
*graminicola* .......... 206
*propinqua* .......... 206
*Deltocephalus dorsalis* .......... 190, 206
*Dendroctonus micans* .......... 65
*Dendrolimus pini* .......... 71
*sibiricus* .......... 83
*Depressaria depressella* .......... 164
*nervosa* .......... 51, 164
*Dermestes frischi* .......... 5
*vulpinus* .......... 5
*Desiantha nociva* .......... 185, 217
*Diabrotica graminea* .......... 85, 155
*Diacrisia obliqua* .......... 91
*Diadoxus erythrurus* .......... 64, 94
*scalaris* .......... 64, 94
*Dialeges pauper* .......... 193
*Diamerus fici* .......... 103
Diamond-back moth (see *Plutella maculipennis*).
*Diaprepes abbreviatus* .......... 30,
60, 64, 85, 126, 132, 146, 192, 200
*spengleri* (see *Diaprepes abbreviatus*).
*Diapus capillatus* .......... 154
*furtivus* .......... 194
*impressus* .......... 154
*mirus* .......... 194
*quinquespinatus* .......... 194
*Diaspidiotus* (see *Aspidiotus* [*Diaspidiotus*]).
*Diaspis atlantica* .......... 139
*bromeliæ* .......... 102
*cattleyæ* .......... 158
*gennadii* .......... 171
*leperii* .......... 132, 166, 220
*oleæ* .......... 156
*pentagona* .......... 5, 52, 169, 178
*Diaspis pyri* .......... 23, 169
*santali* .......... 169
*squamosus* .......... 166, 169
*visci* .......... 25, 73, 94, 139
*zamiæ* .......... 5, 162
*Diastrombus politus* .......... 206
*Diatræa* spp .......... 203
*canella* .......... 203
*lineolata* .......... 203
*saccharalis* .......... 6, 203
*striatalis* .......... 203, 208
*Dichocrocis punctiferalis* .......... 24, 34, 51,
60, 85, 94, 126, 132, 142, 167
*Dicranotropis vastatrix* .......... 206
*Dictyophora sinica* .......... 190, 206
*Diloba cæruleocephala* .......... 21, 179
*Dindymus versicolor* .......... 17, 196
*Dinoderus brevis* .......... 33
*distinctus* .......... 33, 143
*minutus* .......... 31, 207
*pilifrons* .......... 31
*Dioryctria splendidella* .......... 76
*Diostrombus politus* .......... 190
*Diparopsis castanea* .......... 91
*Diphucephala aurulenta* .......... 10
*colaspidoides* .......... 172
*Diploschema rotundicolle* .......... 59
*Diplosis eucalypti* .......... 100
*paralis* .......... 100
*Diprion pallidus* .......... 70
*pini* .......... 70
*rufus* .......... 70
*simile* .......... 6, 70
*Discophora celinde* .......... 208
*Distichocera macleayi* .......... 97
*Dolopius marginatus* .......... 68, 153
*Dorytomus affinis* .......... 222
*agnathus* .......... 222
*dorsalis* .......... 222
*maculatus* .......... 222
*majalis* .......... 222
*Doticus pestilans* .......... 24
*Dreata petola* .......... 208
*Drepana cultraria* .......... 40
*Dreyfusia nuesslini* .......... 67
*piceæ* .......... 67
*Drosicha maskelli* .......... 102
Drugstore beetle (see *Sitodrepa panicea*).
*Dryocœtes alni* .......... 12
*autocraphus* .......... 69
*hewetti* .......... 154
*indicus* .......... 81
*minor* .......... 193
*villosus* .......... 54, 154
*Dryophilus pusillus* .......... 79, 84
*Duomitus ceramicus* .......... 212
Durra stem borer (see *Sesamia cretica*).
*Dysdercus* spp .......... 86
*andreæ* .......... 86
*annuliger* .......... 86
*cardinalis* .......... 86
*cingulatus* .......... 86, 87
*delauneyi* .......... 86
*fasciatus* .......... 86
*fernaldi* .......... 86
*howardi* .......... 86

Page.

- *Dysdercus insularis*, 86
  - *nigrofasciatus*, 86
  - *pacificus*, 86
  - *ruficollis*, 86
  - *sanguinarius*, 86
  - *sidæ*, 86
  - *superstitiosus*, 86
  - *suturellus*, 5, 86
- *Earias chlorana*, 91, 223
  - *chromataria*, 91
  - *fabia*, 91
  - *gossypii*, 91
  - *insulana*, 87
  - *plaga*, 91
- Early moth (see *Hibernia rupicapraria*).
- East African cotton weevil (see *Apion xanthostylum*).
- *Echinocnemis squameus*, 191, 207
- *Ecthœa quadricornis*, 50
- Eggplant fruit borer (see *Leucinodes orbonalis*).
- Egyptian cotton boll worm (see *Earias insulana*).
  - cotton worm (see *Prodenia litura*).
- Eight-toothed large spruce bark beetle (see *Ips typographus*).
- *Elaphodes tigrinus*, 10
- *Elimæa chloris*, 205
- Elm bark beetle (see *Scolytus multistriatus*).
  - leaf beetle (see *Galerucella luteola*).
  - sawfly (see *Fenusa dohrnii*).
- *Enarmonia pinicolana*, 67, 70
  - *rufimitrana*, 77, 78
- *Entochira lateralis*, 198, 216
- *Entodecta pumila*, 47
- *Epacromia tamulus*, 205
- *Epepeotes luscus*, 50, 146
- *Ephestia cautella*, 6, 163
  - *elutella*, 76
  - *kuehniella*, 6
- *Epiblema nigricana* (see *Eucosoma*).
  - *tedella* (see *Laspeyresia*).
- *Epicauta rufidorsum*, 43, 184
  - *sibirica*, 184
- *Epicoccus acaciæ*, 9
- *Epidiaspis piricola*, 5, 23, 24, 121, 166, 169
- *Epilachna* spp, 92, 183
  - *argus*, 92
  - *chrysomelina*, 92
  - *dodecastigma*, 92, 183
  - *guttato-pustulata*, 183
  - *28-maculata*, 183
  - *28-punctata*, 92, 183
  - *phyto*, 183
  - *pusillanina*, 183
  - *territa*, 183
- *Episomus albinus*, 207
- *Ereunetis flavistriata*, 34, 163, 171, 204, 208
  - *muiriella*, 208
  - *pilosata*, 208
- *Eriocampoides limacina*, 6
- *Eriococcus aceris*, 39, 147, 153
  - *angulatus*, 25
  - *araucariæ*, 25
  - *buxi*, 48
  - *confusus*, 99

Page.

- *Eriococcus coriaceus*, 99, 131
  - *crispus*, 102
  - *crofti*, 99
  - *eucalypti*, 99
  - *fagicorticus*, 39
  - *graminis*, 33
  - *gregarius*, 99
  - *irregularis*, 99
  - *lagerstrœmiæ*, 102
  - *onukii*, 33
  - *pallidus*, 39
  - *picta*, 99
  - *raithbyi*, 39
  - *serratilobis*, 99
  - *simplex*, 99
  - *spiniger*, 99
  - *tepperi*, 99
  - *tesselatus*, 99
- *Eriogaster lanestris*, 46, 141, 154, 181, 223
- *Eriophyes* spp, 172
  - *avellanæ*, 133
  - *fraxini*, 26
  - *goniothorax*, 132
  - *gossypii*, 86
  - *lævis*, 11
  - *laricis*, 82
  - *macrochelus*, 147
  - *oleivorus*, 5, 55
  - *padi*, 5, 172
  - *phlæocoptes*, 5, 172
  - *pini*, 70
  - *psilaspis*, 223
  - *pyri*, 5
  - *quadrisetus*, 139
  - *ribis*, 118, 119
  - *rudis*, 45
  - *similis*, 172
  - *tetanothrix*, 222
  - *tiliæ*, 141
  - *tiliarius*, 141
  - *vermiformis*, 133
  - *vitis*, 5, 127
- *Eriosoma lanuginosa*, 95
  - *ulmi*, 95
- *Ernobius abietinus*, 73
  - *abietis*, 79
  - *angusticollis*, 79
  - *longicornis*, 79
  - *nigrinus*, 73
  - *pini*, 73
- *Ernoporus caucasicus*, 141
  - *fagi*, 40
  - *tiliæ*, 141
- *Estigmena chinensis*, 33
- *Etiella zinckenella*, 165
- *Eubactrus* sp, 73
- *Eucalymnatus brunfelsiæ*, 35
- *Eucanthus semiglauca*, 206
- *Euchelia jacobeæ*, 185
- *Euchirus macleayi*, 153
- *Euchloris submissaria*, 10
- *Eucosoma nigricana*, 77
  - *paragramma*, 32
  - *schistacea*, 208
- *Eudamus proteus*, 38
- *Eumerus strigatus*, 139, 157

Page.

- *Eumetopina krugeri* .... 206
- *Euphilippia olivina* .... 156
- *Euplexis nigerrima* .... 185
- *Euproctis chrysorrhœa* .... 6, 40, 107, 132, 137, 148, 154, 181, 192, 223
  - *divisa* .... 212
  - *flavata* .... 208
  - *flexuosa* .... 55
  - *latifascia* .... 212
  - *minor* .... 208
- *Eupteryx solani* .... 184
- European grain moth (see *Tinea granella*).
  - thrips (see *Haplothrips tritici*).
  - hop flea-beetle (see *Psylliodes attenuata*).
  - pine-shoot moth (see *Evetria buoliana*).
- *Euscepes batatæ* .... 209
- *Euura ater* .... 223
- *Euxoa radians* .... 185
  - *segetis* .... 91
  - *spinifera* .... 216
- *Euzophera cedrella* .... 52, 70
- *Evaspidiotus* [see *Aspidiotus* (*Evaspidiotus*)].
- *Evergestis extimalis* .... 49, 87, 188
- *Evetria* spp .... 72
  - *buoliana* .... 6, 70, 72
  - *comstockiana* .... 72
  - *duplana* .... 6, 72
  - *frustrana* .... 72
  - *pinivorana* .... 6, 72
  - *resinella* .... 72
  - *rigidana* .... 72
  - *turionana* .... 6, 72
- Feathery-horned yellow-box borer (see *Distichocera macleayi*).
- *Feltia* sp .... 6
- *Fenusa dohrnii* .... 6
- Fig branch borer (see *Hylesinus porcatus*).
  - moth (see *Ephestia cautella*).
  - stem-boring beetle (see *Sinoxylon sudanicum*).
  - tree borer (see *Batocera boisduvali*).
- Figure-of-8-moth (see *Diloba cæruleocephala*).
- Fiji fly (see *Dascus passifloræ*).
- *Filippia oleæ* .... 156
- *Fiorinia acaciæ* .... 9
  - *bambusæ* .... 32
  - *diaspiformis* .... 32
  - *grossulariæ* .... 121
  - *signata* .... 32
  - *stricta* .... 158
  - *tenuis* .... 32
  - *theæ* .... 156, 212
- Fir bark tortricid (see *Laspeyresia duplicana*).
  - bud worm (see *Eucosoma nigricana*).
- Flatheaded leaf-miner beetle (see *Aphanistichus consanguineus*).
  - wood borer (see *Agrilus viridis*).
- Flax capsule worm (see *Phalonia epilinana*).
- Flea beetle (see *Phyllotreta atra*).
- Flour beetles .... 122
- Fluted scale (see *Icerya purchasi*).
- *Fonscolombia fraxini* .... 26

Page.

- Forest defoliators (see *Melolontha melolontha*).
- *Frea maculicornis* .... 63
  - *marmorata* .... 63
- Frit fly (see *Chlorops lineata; Oscinis frit*).
- Fruit tree bark beetle (see *Scolytus rugulosus*).
  - borer (see *Capnodis tenebrionis*).
- *Furcaspis oceanica* .... 158, 162
- *Galerucella luteola* .... 6
  - *tenella* .... 197
- *Gallobellicus crassicornis* .... 215
- *Gasterocercodes gossypii* .... 91
- *Gastropacha quercifolia* .... 24, 111, 132, 170, 179, 223
- *Gastrophora henricaria* .... 99
- *Gazalina apsara* .... 154
- *Gelastorhinus esox* .... 205
- *Gelechia atriplicella* .... 41
  - *dodecella* .... 70
  - *gossypiella* (see *Pectinophora*).
  - *instabilella* .... 41
  - *ocellatella* .... 41, 42
- *Gelonætha hirta* .... 212
- *Geococcus radicum* .... 146
- *Geoica lucifuga* .... 207
- *Geonomus quadrinodosus* .... 64
- Giant sugar cane borer (see *Castnia licus*).
- Giffard fruit fly (see *Ceratitis giffardi*).
  - white fly (see *Bemisia giffardi*).
- Gipsy moth (see *Porthetria dispar*).
- *Glenea novemguttata* .... 50
- *Glyphina betulæ* .... 45
- *Gnathodus pallidulus* .... 206
  - *viridis* .... 206
- *Gnorimoschema heliopa* .... 215
- Goat moth (see *Cossus cossus*).
- *Gonocephalum intermedium* .... 216
- *Gonocephalum* (*Opatrum*) *acutangulum* .... 207, 216
  - *pusillum* .... 216
  - *sabulosum* .... 43, 73
- Gooseberry moth (see *Zophodia convolutella*).
- *Gortyna flavago* .... 185
  - *ochracea* .... 185
- *Gossyparia cavellii* .... 39
  - *spuria* .... 96
- *Gracillaria syringella* .... 27
- Grain fly (see *Camarota flavitarsis*).
- Grape anomala (see *Anomala vitis*).
  - blister mite (see *Eriophyes vitis*).
  - borers (see *Vesperus* spp.).
  - gun worm (see *Sciopteron regale*).
  - pyralid (see *Polychrosis botrana*).
  - root weevils (see *Brachyrhinus* spp.).
    - worm (see *Bromius* spp.).
  - vine flatheaded borer (see *Sinoxylon* spp.).
  - worm (see *Clysia ambiguella*).
- *Grapholitha* (see *Laspeyresia* spp.).
- Grass army worm (see *Spodoptera mauritia*).
- Gray borer of the sugar cane (see *Laspeyresia schistaceana*).
  - fruit tree bud moth (see *Olethreutes cynobatella*).
  - larch moth (see *Enarmonia pinicolana*).
  - plum owlet moth (see *Xylina ornithopus*).
- Greasy cutworm (see *Agrotis ypsilon*).
- Great oak borer (see *Cerambyx cerdo*).

Page.

Greedy scale (see *Aspidiotus camelliæ*).
Green hanging moth of the apple (see *Charagia lignivora*).
  leaf weevil (see *Phyllobius maculicornis*).
  pug moth (see *Chloroclystis rectangulata*).
  oak tortrix (see *Tortrix viridana*).
*Gryllotalpa africana* 89, 190, 205, 215
  *gryllotalpa* 43, 45, 215
  *vulgaris* (see *Gryllotalpa gryllotalpa*).
*Gryllus melas* 43
  *mitratus* 205
*Gueriniella serratulæ* 73, 94, 96, 130, 150
Gum tree bug (see *Mictis profana*).
*Gunda sikkima* 103
Gypsy moth (see *Porthetria dispar*).
*Hadena secalis* 125
*Halimococcus lampas* 162
*Haltica ampelophaga* 128, 222
  *quercetorum* 12, 39, 46, 134, 151, 192, 222
*Haplothrips aculeata* 125
  *tritici* 125
Harlequin fruit bug (see *Dindymus versicolor*).
*Harpalus æneus* 81
  *ruficornis* 196
Hawaiian beet webworm (see *Hymenia fascialis*).
  leaf bug (see *Hyalopeplus pellucidus*).
  sugar-cane borer (see *Rhabdocnemis obscurus*).
  sugar-cane leafroller (see *Omiodes accepta*).
Hawthorne scale (see *Lecanium bituberculatum*).
Hazelnut blister mites (see *Eriophyes avellanæ; Eriophyes vermiformis*).
*Hedotettix arcuatus* 205
*Heilipus bonelli* 101
  *lauri* 30
*Heliothrips rubrocinctus* 5, 50, 63, 109, 132, 140, 146, 192, 218
  *striatoptera* 207
*Hellula undalis* 6, 186
*Helopeltis antonii* 50
  *theivora* 50
*Hemiberlesia* (see *Aspidiotus* [*Hemiberlesia*]).
*Hemichionaspis* sp 11
  *fici* 102
  *minima* 102
  *scrobicularum* 32
*Hemirhopala atrilineata* 150
*Hepialus humuli* 85, 135, 185, 188
  *lupulinus* 185
*Herse convolvuli* 210
*Hesperia conjuncta* 208
  *philino* 208
Hessian fly (see *Phytophaga destructor*).
*Heterachthes æneolus* 131
*Heterobostrichus æqualis* 193, 194
  *pileatus* 193
  *unicornis* 33
*Heteroplia varians* 193
*Heterorhina hookeri* 10

Page.

*Heterusia cingala* 212
*Hibernia aurantiaria* 40, 46, 132, 141, 154, 181
  *defoliaria* 24, 40, 46, 96, 106, 132, 137, 141, 149, 154, 181, 192
  *marginaria* 40, 46, 132, 137, 141, 154, 181
  *rupicapraria* 111, 179
*Hieroglyphus banian* 190
*Himatium asperum* 193
*Hispa ænescens* 190
  *callicantha* 190, 207
  *wakkeri* 199
*Holaniara picescens* (see *Entochira lateralis*).
*Holotrichia leucophthalma* 207
  *vidua* 207
*Holzneria poschingeri* (see *Prociphilus bumeliæ*).
Hop aphis (see *Phorodon humuli*).
  leaf miner (see *Agromyza frontalis*).
  midge (see *Cecidomyia humuli*).
  root borer (see *Hepialus humuli*).
*Hoplocampa fulvicornis* 24, 177, 178
  *rutilicornis* 180
  *testudinea* 22, 23
*Hoplocerambyx spinicornis* 193
*Hormomyia annulipes* 40
  *fagi* 40
Hornet moths (see *Trochilium* spp.).
Horse-chestnut borer (see *Zeuzera pyrina*).
*Hyalopeplus pellucidus* 37
*Hydrellia griseola* 125
*Hydrœcia micacea* 185
*Hylastes angustatus* 74
  *ater* 74
  *attenuatus* 69
  *cunicularius* 81
  *decumanus* 69
  *himalayensis* 69
  *longifolia* 74
  *opacus* 74
*Hylecœtus dermestoides* 39, 46, 79, 148, 153
*Hylemyia antiqua* 157
  *coarctata* 124
*Hylesinus crenatus* 27, 154
  *fraxini* 27, 157
  *oleæ* 157
  *oleiperda* 27
  *porcatus* 101
  *vestitus* 157
*Hylobius abietis* 12, 40, 46, 68
  *fatuus* 68
  *piceus* 68
*Hylotrupes bajulus* 68
*Hylurgops glabratus* 81
  *palliatus* 69
*Hylurgus ligniperda* 74
*Hymenia fascialis* 6, 42, 43
*Hypena rostralis* 137
*Hypera* spp 61, 184
  *crinita* 184
  *fasciculata* 51
  *meles* 6, 14, 61
  *miles* 61
  *murina* 13, 61
  *nigrirostris* 6, 61, 158
  *ononidis* 61, 158
  *pastinacæ tigrina* 51

Page.

- *Hypera postica* 6,14,15
  - *punctata* 6,14,51,61
  - *rogenhoferi* 51
  - *rumicis* 189
  - *variabilis* 38,47,61,184,185
- *Hypoborus ficus* 103
- *Hypœschrus indicus* 193
- *Hypomeces curtus* 63
  - *unicolor* 191,207
- *Hyponomeuta evonymella* 48
  - *malinellus* 21,180
  - *padellus* 21,180
  - *padi* 48
- *Hysipyla robusta* 142,218
- *Icerya ægyptiaca* 102
  - *albolutea* 94
  - *maxima* 102
  - *minor* 145
  - *montserratensis* 30,35,59,131,162,192
  - *palmeri* 102,130
  - *purchasi* 5
  - *seychellarum* 59,102,131,146,162,192,206
- Imported cabbage butterfly (see *Pontia rapæ*)
  - maggot [see *Chortophila* (*Pegomya*) *brassicæ*].
  - clover weevil (see *Miccotrogus picirostris*).
  - onion maggot (see *Pegomya cepetorum*).
- *Ina ampelophaga* 131
- *Incurvaria capitella* 121
- Indian meal moth (see *Plodia interpunctella*).
  - tea geometrid (see *Biston suppressarius*).
- *Inesida leprosa* 163
- *Inglisia conchiformis* 131
  - *fagi* 39
- *Ips acuminatus* 74
  - *amitinus* 69
  - *blandfordi* 74
  - *cembræ* 69
  - *duplicatus* 69
  - *longifolia* 74
  - *mannsfeldi* 74
  - *ribbentropi* 69
  - *sexdentatus* 69
  - *stebbingi* 52
  - *typographus* 66,69
- Island fruit fly (see *Rioxa musæ*).
- *Isosoma noxiale* 126
- *Itycorsia campestris* 77
  - *stellata* 70
- *Janus compressus* 169
  - *cynosbati* 154
  - *fumipennis* 47
  - *luteipes* 192
- Japanese grain moth (see *Melissoblaptes gularis*).
  - rose beetle (see *Adoretus umbrosus*).
- *Jassus sexnotatus* 125
- Java cinchona geometrid (see *Boarmia crepuscularia*).
  - sugarcane grub beetle (see *Apogonia* spp.).
- June beetle (see *Melolontha* spp.).

Page.

- Juniper blister mite (see *Eriophyes quadrisetus*).
- *Kakivoria flavofasciata* 170
- *Kermes acaciæ* 9
  - *bacciformis* 153
  - *ballotæ* 153
  - *cordiformis* 153
  - *gibbosus* 153
  - *ilicis* 153
  - *pallidus* 153
  - *roboris* 153
  - *vermilio* 153
- *Kirbya pagana* 206
- *Kuwania parva* 178
- *Lachnosterna* (see *Phyllophaga*).
- *Lachnus agilis* 72
  - *fasciatus* 81
  - *grossus* 78,81
  - *laricis* 84
  - *nudus* 72
  - *piceæ* 78,81
  - *pichtæ* 78
  - *pini* 72
  - *pinicola* 81
  - *tæniatus* 72
  - *tomentosus* 72
  - *viminalis* 222
- Lackey moth (see *Malacosoma neustria*).
- *Lacon* sp. near *davidi* 81
  - *murinus* 43,153,184
  - *shirakii* 207
- *Lælia costalis* 208
  - *subrufa* 208
- *Læmophlœus testaceus* 193
- *Læmotmetus rhizophagoides* 190
- *Lagosinia strachani* 94
- *Lamia textor* 181,222
- *Lampra assamensis* 103
  - *decipiens* 96
  - *rutilans* 12,96,141
  - *undatus* 141
- *Laphygma exigua* (*Caradrina*) 6,14,210
  - *reclusa* 210,216
- Lappet moth (see *Gastropacha quercifolia*).
- Larch blister mite (see *Eriophyes laricis*).
  - bud-gall midge (see *Dasyneura laricis*).
  - gall moth (see *Laspeyresia zebeana*).
  - needle miner (see *Coleophora laricella*).
  - sawfly (see *Nematus erichsoni*).
  - shoot moth (see *Argyresthia lævigatella*).
  - spinner (see *Dendrolimus sibiricus*).
  - tussock moth (see *Dasychira selenitica*).
- *Larentia dilutata* 12,40,46,96,154,223
  - *nebulata* 46
- Large Australian fruit fly (see *Dacus æqualis*).
  - bast beetle (see *Dendroctonus micans*).
  - pith borer [see *Tomicus* (*Myelophilus*) *piniperda*].
  - pear psylla (see *Psylla pyrisuga*).
- *Lasiocampa quercus* 75,154
  - *trifolii* 60
- *Lasioderma serricorne* 6
- *Lasioptera cerealis* 124
  - *miscella* 100

Page.

- *Laspeyresia* spp 165
  - *amplana* 134, 220
  - *coniferana* 79
  - *dorsana* 165
  - *duplicana* 67, 140
  - *funebrana* 176
  - *glycinivorella* 196
  - *grossana* 38, 54, 134, 154, 196, 220
  - *nebritana* 165, 196
  - *nigricana* 6, 165
  - *pactolana* 79, 80
  - *pomonella* 6
  - *proximana* 79
  - *prunivorana* 179
  - *schistaceana* 204
  - *splendana* 53, 54, 154, 220
  - *strobilella* 80
  - *tedella* 80, 81
  - *wœberiana* 176
  - *zebeana* 83
- *Latheticus oryzæ* 122
- Leaf hispa (see *Brontispa froggatti*).
- Leather beetle (see *Dermestes* spp).
- *Lecaniodiaspis acaciæ* 9
  - *africana* 9, 102
  - *convexus* 98
  - *dilatata* 9
  - *frenchi* 98
  - *newmanni* 98
  - *sardoa* 192
- *Lecanium aceris* 147
  - *arion* 25
  - *bituberculatum* 5, 23, 132, 169
  - *capreæ* 11, 23, 169
  - *catori* 140
  - *caudatus* 63
  - *cerasi* 178
  - *cerasorum* 178
  - *ciliatum* 45, 48, 153, 181, 222
  - *corni* 11
  - *coryli* 11, 24, 45, 95, 96, 121, 132, 134, 137, 138, 141, 147, 153, 169, 178, 181, 186, 220, 222
  - *glandi* 23, 169
  - *guerinii* 206
  - *krugeri* 206
  - *kunoensis* 24, 166, 169
  - *perornatum* 191
  - *persicæ* 23, 130, 166, 186
  - *prunastri* 24, 179
  - *pseudexpansum* 162
  - *pulchrum* 45, 53, 134, 137, 153, 191
  - *pyri* 23
  - *rehi* 121
  - *rubi* 121
  - *rugosum* 23, 166, 169, 179, 186
  - *sericeum* 79
  - *tiliæ* 169
  - *variegatum* 23
  - *vini* 23, 24, 130, 166, 169
- *Leiomerus granicollis* 51
- *Lema cyanella* 122
  - *flavipes* 191
  - *melanopus* 122
- Lemon caterpillar (see *Papilio demoleus*).
  - silver mite (see *Eriophyes oleivorus*).

Page.

- *Lepidiota bimaculata* 193
- *Lepidosaphes abietis* 79
  - *acaciæ* 9
  - *bambusicola* 32
  - *beckii* 5
  - *cocculi* 158
  - *corrugata* 63
  - *duponti* 162
  - *ficifolii* 102
  - *ficus* 5
  - *juniperi* 139
  - *longula* 30
  - *mcgregori* 162
  - *mexicana* 102
  - *minima* 102
  - *newsteadi* 73
  - *olivina* 156
  - *pallida* 158
  - *pinnæformis* 59
  - *somalensis* 9
  - *spinifera* 9
  - *ulmi* 5
  - *unicolor* 162
- *Leptocorisa varicornis* 190, 207
- *Leptodictya tabida* 207
- *Leptoglossus* spp 97
- *Leptops hopei* 17, 18, 170, 179
  - *tribulus* 10
- *Leptostylus præmorsus* 56
- *Leptura rubriola* 81
- Lesser grain borer (see *Rhizopertha dominica*).
- *Leucania loreyi* 208
  - *unipuncta* (see *Cirphis*).
- *Leucaspis bambusæ* 32
  - *indica* 5, 146
  - *japonica* 5, 23, 32, 192
  - *lœwi* 73
  - *pini* 73
  - *pistaciæ* 171
  - *pusilla* 73
  - *riccæ* 156
  - *signoreti* 73
- *Leucinodes orbonalis* 95
- *Leucodiaspis cockerelli* 44, 162
- *Leucoma diaphana* 194
- *Leucophlebia lineata* 208
- *Leucoptera coffeella* 62
- *Leucotermes lucifugus* 7
- *Levuana iridescens* 159, 163
- Liberian sweet-potato borer (see *Cylas brunneus*).
- *Lichtensia eatoni* 156
  - *lutea* 102
  - *viburni* 219
- Light-brown apple moth (see *Tortrix ashworthana*).
- *Ligyrus rugiceps* 207
- *Limnophilus flavicornis* 220
- *Limothrips denticornis* 125
- *Limonius æruginosus* 153
- *Lineodes ochracea* 185
- *Liogryllus bimaculatus* 205
  - *formosanus* 205
- *Liopus nebulosus* 23, 25, 169. 179
- *Liparus coronatus* 44, 51

Liriodenus [illegible]
" apicalis Walsh,

Page.
*Lita* (see *Gelechia*).
Little bollworm (see *Pyroderces simplex*).
*Lixus ascanii* .......... 44
*vetula* .......... 207
*Lochmæa capreæ* .......... 46
*Locusta viridissima* .......... 215
*Lonchæa splendida* .......... 95, 185, 217
Longheaded flour beetle (see *Latheticus oryzæ*).
*Lophocateres* (*Ostoma*) *pusillus* .......... 122
*Lophodes sinistraria* .......... 10, 25
*Lophosternus hugeli* .......... 153
Lucern moth of New South Wales (see *Tortrix divulsana*).
*Ludius suturalis* .......... 207
*Luperus pinicola* .......... 73
*Lycæna bætica* .......... 37
*Lyctus brunneus* .......... 188
*linearis* .......... 153
*spinifrons* .......... 33, 218
*Lygæonematus ambiguus* .......... 82
*pini* .......... 82
*saxeseni* .......... 82
*Lygesis mendica* .......... 10
*Lygus oryzæ* .......... 190, 207
*pratensis* .......... 5
*sacchari* .......... 207
*Lymantria brittata* .......... 194
*grandis* .......... 194
*lipcha* .......... 194
*monacha* .......... 40, 47, 48, 70, 108, 134, 137, 141, 148, 149, 154, 181, 223
*Lymexylon navale* .......... 153
*Lytta vesicatoria* .......... 26
*Machærota planitiæ* .......... 90
*Macrophya punctum-album* .......... 27, 133, 154
*Macrosiphum fragariæ* .......... 196
*fragariellum* .......... 193
*pisi* .......... 5, 165
*rogersii* .......... 196
*Macrothylacia rubi* .......... 47
*Magdalis* spp .......... 65
*armigera* .......... 173
*aterrima* .......... 96
*barbicornis* .......... 17, 132, 149, 187
*carbonaria* .......... 45, 134, 179, 220
*cerasi* .......... 23, 132, 170, 179
*duplicata* .......... 65
*memnonia* .......... 65
*phlegmatica* .......... 65
*pruni* .......... 23, 132, 179, 187
*rufa* .......... 65
*violacea* .......... 65
Magpie moth (see *Abraxas grossulariata*).
*Malacosoma neustria* .......... 40, 46, 106, 154, 181, 192, 223
*Mamestra albicolor* .......... 216
*brassicæ* .......... 44, 50, 141, 216
*dissimilis* .......... 44
*oleracea* .......... 29, 44, 50
Mandarin fruit fly (see *Dacus ornatissimus*).
Mango bark borer (see *Plocæderus ruficornis*).
borer (see *Batocera titana; Dinoderus distinctus*).
fruit fly (see *Dacus ferrugineus*).
scale (see *Coccus mangiferae; Leucaspis indica*).
Mango shoot psylla (see *Psylla cistellata*).
weevil (see *Sternochetus mangiferæ*).
March moth (see *Anisopteryx æscularia*).
*Margarodes formicarum* .......... 206
Marguerite fly (see *Phytomyza affinis*).
*Maruca testulalis* .......... 37
*Massicus unicolor* .......... 153
Masters' gum borer (see *Trypocharia mastersi*).
Mauritius fruit fly (see *Ceratitis catoirei*).
*Mayetiola avenæ* .......... 124
*destructor* (see *Phytophaga*).
*Mecopoda elongata* .......... 205
Mediterranean flour moth (see *Ephestia kuehniella*).
fruit fly (see *Ceratitis capitata*).
*Megastigmus brevicaudus* .......... 149
*borriesi* .......... 79
*strobilobius* .......... 70
*Meges marmoratus* .......... 153
*Melanimon tibiale* .......... 73
*Melanitis leda* .......... 208
*Melanophila picta* .......... 181
*Melasoma ænea* .......... 12, 46
*populi* .......... 222
*Meligethes æneus* .......... 188, 218
*Melissoblaptes gularis* .......... 191
*Melobasis splendida* .......... 10
*Melolontha castanipes* .......... 215
*hippocastani* .......... 10, 12, 26, 39, 46, 54, 73, 96, 137, 138, 141, 148, 149, 153, 171, 181, 222
*melolontha* .......... 10, 12, 26, 39, 46, 54, 73, 96, 104, 137, 138, 141, 148, 149, 153, 171, 181, 222
*niger* .......... 215
*rufipes* .......... 215
*tenebrosus* .......... 215
*vulgaris* .......... 43, 104, 215
Melon aphis (see *Aphis gossypii*).
fruit fly (see *Carpomyia pardalina*).
weevil (see *Baris trægardhi*).
*Menida histrio* .......... 207
*Merodon clavipes* .......... 150
*equestris* .......... 150
*Mesites aquitanus* .......... 74
Metallic tomato fly (see *Lonchæa splendida*).
*Metallites atomarius* .......... 68
*iris* .......... 46, 154
*laricis* .......... 68
*mollis* .......... 68
*Metamasius hemipterus* .......... 200
*ritchiei* .......... 171
*sericeus* .......... 200
*Metanastria hyrtaca* .......... 55
Mexican bean weevil (see *Spermophagus pectoralis*).
fruit fly (see *Anastrepha ludens*).
grain beetle (see *Pharaxontha kirschi*).
*Miccotrogus picirostris* .......... 61
*Micromima olivia* .......... 95, 216, 217
*Mictis profana* .......... 97
Millet stalk worm (see *Pyrausta nubilalis*).
*Mindarus abietinus* .......... 67
Mites (see Acarina).
*Mnesampela privata* .......... 99
*Moecha adusta* .......... 50, 195

Page.

- *Moecha büttneri* 63
  - *molator* 63
- *Mogannia hebes* 207
- Mole crickets (see *Gryllotalpa* spp.; *Schizodactylus* spp.).
- *Molorchus minor* 79
- *Monarthropalpus buxi* 48
- *Monoctenus juniperi* 134
- *Monohammus fistulator* 50, 63
  - *galloprovincialis* 73
  - *ruspator* 50
  - *sartor* 68
- *Monolepta nigrobilineata* 207
- *Monophlebus stebbingi octocaudata* 102
- Moon-flecked moth (see *Phalera bucephala*).
  - spot moth (see *Phalera bucephala*).
- Morganella [see *Aspidiotus* (*Morganella*)].
- Mottled umber moth (see *Hibernia defoliaria*).
- *Mudaria cornifrons* 194
- *Mycalesis mineus* 208
- *Myelophilus* [see *Tomicus* (*Myelophilus*)].
- *Myllocerus acaciæ* 10
  - *brunneus* 207
  - *carinirostris* 212
  - *discolor variegatus* 212
  - *guttulus* 207
  - *viridanus* 212
- *Mylabris* sp 6, 35
  - *affinis* 36
  - *atomarius* 36
  - *lentis* 6, 36, 165
  - *loti* 36
  - *pallidicornis* 36, 165
  - *pisorum* 6, 36, 165
  - *rufimanus* 6, 36, 165
- *Myzus persicæ* 5
- *Nacerdes melanura* 213
- *Nanophyes tamaricis* 211
- Narcissus fly (see *Merodon* spp.).
- Natal fruit fly (see *Ceratitis rubivora*).
- *Necrobia rufipes* 5
- Needle-nose hopbug (see *Calocoris fulvomaculatus*).
- *Nematus erichsoni* 6
  - (*Croesus*) *septentrionalis* 13, 47, 149, 182
- *Neolecanium plebeium* 102
  - *silveirai* 130
- *Neomaskellia bergii* 207
- *Nephopteryx rubrizonella* 168
  - *sagittiferella* 57
- *Nephotettix apicalis* 190, 206
- *Nepticula sericopeza* 148
- *Nesosydne ipomœicola* 210
- *Nezara viridula* 207, 215
- *Nicertoides saccharivora* 206
- *Nidularia pulvinata* 153
- Nigeria fruit fly (see *Ceratitis nigerrima*).
- *Nirvana pallida* 206
  - *suturalis* 206
- *Nisia atrovenosa* 190, 206
- *Nitocris usambica* 63
- *Nodostoma lateralis* 207
- *Nola metallopa* 99
- *Nonagria exitiosa* 208
  - *inferens* 191, 208
  - *uniformis* 123, 208

Page.

- Northern mango weevil (see *Sternochetus gravis*).
  - peach moth (see *Conogethes punctiferalis*).
- *Nothorhina muricata* 73
- *Notocelia roborana* 47, 121, 154, 192
- Nun moth (see *Lymantria monacha*).
- Nut fruit tortrix (see *Laspeyresia splendana*).
  - tortrix (see *Laspeyresia amplana*).
  - weevil (see *Curculio nucum*).
- *Nymphula depunctalis* 191
  - *fluctuosalis* 191
- *Nysius minor* 215
  - *vinitor* 109, 125, 130, 166, 179
- Oak bud moth (see *Coleophora lutipennella*).
  - flea beetle (see *Haltica quercetorum*).
  - procession moth (see *Cnethocampa processiona*).
  - scales (see *Asterolecanium variolosum*).
- Oat gall midge (see *Mayetiola avenæ*).
- *Oberea linearis* 12, 96, 133, 134, 220
  - *oculata* 222
- Oblong leaf weevil (see *Phyllobius oblongus*).
- *Ochsenheimeria taurella* 123
- *Ocinara dilectula* 103
  - *lewinii* 99
  - *signifera* 103
- *Ocneria detrita* 154
- *Ocnerostoma piniariella* 76
- *Ocrophara montana* 33
- *Odonaspis* [see *Aspidiotus* (*Odonaspis*)].
- *Odonestis australasiæ* 24, 100
  - *plagifera* 55
  - *pruni* 112
- *Œcanthus indicus* 205
- *Œcophora oliviella* 157
- *Œdaleus infernalis* 205
  - *nigrofasciatus* 205
- *Olenecamptus bilobus* 103
- *Olethreutes cynobatella* 113
  - *hercyniana* 79
  - *pruniana* 177
  - *variegana* 179
- *Oliarus oryzæ* 206
- Olive fly (see *Dacus oleæ*).
  - moth (see *Prays oleellus*).
  - white fly (see *Aleurolobus olivinus*).
- *Omiodes accepta* 203
- *Omphisa anastomosalis* 209
- *Oncopeltus quadriguttatus* 90
- Onion fly (see *Eumerus strigatus*).
  - maggot (see *Hylemyia antiqua*).
  - thrips (see *Thrips tabaci*).
- *Opatrum* [see *Gonocephalum* (*Opatrum*)].
- *Ophonus pubescens* 81
- *Ophthalmodes cretacea* 212
- *Opisthoscelis conica* 99
  - *fibularis* 99
  - *globosa* 99
  - *maculata* 99
  - *mammularis* 99
  - *maskelli* 99
  - *nigra* 99
  - *pisiformis* 99
  - *serrata* 99
  - *spinosa* 99

Page.
*Opisthoscelis subrotunda* ... 99
  *verrucula* ... 99
*Opogonia apicalis* ... 208
  *aurisquamosa* ... 208
  *dimidiatella* ... 208
  *fumiceps* ... 208
  *saccharella* ... 208
*Opomysa florum* ... 126
Orange rust mite (see *Eriophyes oleivorus*).
*Orchestes alni* ... 12,96
  *decoratus* ... 222
  *fagi* ... 40
  *ferrugineus* ... 96
  *populi* ... 181,222
  *rufus* ... 96
  *salicis* ... 181
  *testaceus scutellaris* ... 12
*Oregma lanigera* ... 207
*Orgyia antiqua* ... 70,149,223
  *gonostigma* ... 112
  *postica* ... 64,212
*Oria musculosa* ... 126
*Orthezia insignis* ... 59,212
  *prælonga* ... 59
*Ortheziola fodiens* ... 63
*Orthorrhinus cylindrirostris* ... 60
  *kluggi* ... 131
*Orthotomicus erosus* ... 74
  *laricis* ... 69
  *longicollis* ... 74
  *proximus* ... 69
  *suturalis* ... 69
*Oryctes rhinoceros* ... 160,207
*Oscinis frit* ... 125
  *pusilla* (see *Oscinis frit*).
*Ostoma* [see *Lophocateres* (*Ostoma*)].
*Otiorhynchus* (see *Brachyrhinus*).
*Oxya annulicornis* ... 205
  *intricata* ... 190,205
  *velox* ... 190,205
*Oxycarenus dudgeoni* ... 90
  *gossipinus* ... 90
  *hyalinipennis* ... 90
  *lætus* ... 90
*Oxythrips binervis* ... 207
*Oxythyrea funesta* ... 216
Oyster-shell scale (see *Lepidosaphes ulmi*).
*Pachnæus azurescens* ... 63
  *litus* ... 63
*Pachydissus sericus* ... 10
*Pachymerus chinensis* ... 6,36,37,165
  *quadrimaculatus* ... 6,36,37,165
*Pachyrhina crocata* ... 70
  *maculata* ... 44
*Pachytus sulcicollis* ... 215
*Pachtylus migratoriodes* ... 205
  *migratorius* ... 26
*Pachyzancla phæopteralis* ... 185
Painted apple moth (see *Teia anartoides*).
*Palæococcus fuscipennis* ... 73,147,153
  *rosæ* ... 130
*Palembus ocularis* ... 210
Palm weevil (see *Rhynchophorus palmarum*).
*Pamphila dara* ... 208
*Pamphilius flaviventris* ... 169,180

Page.
*Panolis griseovariegata* ... 71
Papaya fruit fly (see *Toxotrypana curvicauda*).
*Papilio demoleus* ... 57
  *idæus* ... 60
*Paralecanium cocophyllæ* ... 162
  *expansum* ... 102
  *geometricum* ... 35
*Paralipsa modesta* ... 191
*Paraphrus granulosus* ... 153
*Parasa lepida* ... 64
*Paratettix gracilis* ... 205
  *singularis* ... 205
*Parlatoria affinis* ... 23,26,156,166
  *blanchardii* ... 162
  *calianthina* .. 23,24,35,59,156,166,169,192
  *cinerea* ... 59
  *greeni* ... 162
  *myrtus* ... 219
  *mytilaspiformis* ... 158,162
  *proteus* ... 5,158,162
    *virescens* ... 192
  *pseudaspidiotus* ... 5,146,158
  *pyri* ... 23,169
  *sinensis* ... 59
  *ziziphus* ... 5,59,131
*Parnara mathias* ... 191,208
*Paropsis picea* ... 10
*Parthenothrips* (?) *kobusi* ... 207
Pea aphis (see *Macrosiphum pisi.*).
  midge (see *Contarinia pisi*).
  moths (see *Laspeyresia* spp.).
  pod borer (see *Etiella zinckenella*).
  weevils [see *Mylabris* (*Bruchus*) spp.].
Peach fruit fly (see *Dacus persicæ*).
Pear borer (see *Agrilus sinuatus*).
  fruit borer (see *Nephopteryx rubrizonella*).
  gall midge (see *Contarinia pyrivora*).
  leaf blister mite (see *Eriophyes pyri*).
    curling midge (see *Dasyneura pyri*).
  scale (see *Aspidiotus ostreæformis*).
  thrips (see *Tæniothrips pyri*).
  tingis (see *Stephanitis pyri*).
  tree psylla (see *Psylla pyricola*).
*Pectinophora gossypiella* ... 88
*Pedinus femoralis* ... 43,216
*Pegomya* [see *Chortophila* (*Pegomya*) spp.].
*Peltophora pedicillata* ... 103,172
*Pemphigus bursarius* ... 181
  *filaginis* ... 181
  *immunis* ... 181
  *marsupialis* (see *P. filaginis*).
  *napæus* ... 181
  *vesicalis* ... 181
*Pentodon punctatus* ... 216
Perak pomelo moth (see *Nephopteryx sagittiferella*).
*Peridroma* sp ... 6
*Periscopus mundulus* ... 207
*Perkinsiella* spp ... 206
  *amboinensis* ... 206
  *bicoloris* ... 206
  *graminicola* ... 206
  *lalokensis* ... 206
  *pallidula* ... 206
  *papuensis* ... 206

Page.
*Perkinsiella rattlei*.......... 206
*saccharicida*.......... 198, 206
*sinensis*.......... 206
*variegata*.......... 206
*vastatrix*.......... 206
*vitiensis*.......... 206
*Peronea ferrugana*.......... 12, 40, 47
*Persectania evengi*.......... 185
Peruvian cotton-square weevil (see *Anthonomus vestitus*).
fruit fly (see *Anastrepha peruviana*).
potato weevil (see *Trypopremnon latithorax; Premnotrypes solani*).
*Petrognatha gigas spinosa*.......... 103
*Phænops cyanea*.......... 73
*Phalera bucephala*.......... 12, 40, 47, 96, 108, 134, 192
*combusta* (see *Anticyra*).
*Phalonia epilinana*.......... 104
*Phaonia trimaculata*.......... 49
*Pharaxonotha kirschi*.......... 122
*Phenacaspis* [see *Chinaspis* (*Phenacaspis*)].
*Phenacoccus aceris*.......... 11, 134, 222
*iceryoides*.......... 146
*mangiferæ*.......... 146
*pergandei*.......... 170
*piceæ*.......... 81
*socius*.......... 121
*Phenacoleachia zealandica*.......... 39
*Phenice maculosa*.......... 206
*moesta*.......... 206
*Philephedra theobromæ*.......... 50
Philippine orange moth (see *Prays citri*).
*Phissama interrupta*.......... 208
*Phlæoba infumata*.......... 205
*Phlœophthorus spinulosus*.......... 81
*rhododactylus*.......... 81
*Phlœosinus thujæ*.......... 25, 140
*zhobi*.......... 74
*Phlœothrips lucasseni*.......... 207
*oleæ*.......... 156
*pallidicornis*.......... 207
*Phlœotribus caucasicus*.......... 27
*oleæ*.......... 157
*Phlyctænia despecta*.......... 210
*ferrugalis*.......... 6, 44
*Phœnicococcus marlatti*.......... 162
*Phoracantha recurva*.......... 97
*tricuspis*.......... 97
*Phorbia vicina* [see *Chortophila* (*Pegomya*) *hyoscyami*].
*Phorodon humuli*.......... 5
*Phosphuga atrata*.......... 43
*Phryneta cœca*.......... 195
*conradti*.......... 103
*hecphora*.......... 195
*spinator*.......... 103
*Phthorimæa operculella*.......... 216, 217
*Phycita abietella*.......... 52, 70
*infusella*.......... 91
*Phylaitis* sp.......... 91
*Phylan gibbus*.......... 73, 153
*Phyllaphis fagi*.......... 39
*Phyllobius argentatus*.......... 39, 46
*betulæ*.......... 46
*maculicornis*.......... 17, 46
Page.
*Phyllobius oblongus*.......... 110
*pyri*.......... 46
*sinuatus*.......... 46
*urticæ*.......... 39
*viridicollis*.......... 39
*Phyllocnistis citrella*.......... 58
*Phyllodecta* spp.......... 221
*tibialis*.......... 221
*vitellinæ*.......... 6, 181, 221
*vulgatissima*.......... 221
*Phyllognathus dionysius*.......... 190
*Phyllopertha horticola*.......... 109
*Phyllophaga clypealis*.......... 193
*problematica*.......... 193
*Phyllotoma vagans*.......... 13
*Phyllotreta* spp.......... 91
*armoraciæ*.......... 6, 91, 138
*atra*.......... 44, 91, 138
*cruciferæ*.......... 44, 91
*nemorum*.......... 44, 91, 137, 189
*nigripes*.......... 44, 91, 138
*undulata*.......... 91
*vittata*.......... 6
*vittula*.......... 44, 126, 187
*Phymatodes lividus*.......... 138, 153, 222
*testaceus*.......... 153
*Physokermes piceæ*.......... 81
*Physopus sexnotatus*.......... 207
*Phytalus smithi*.......... 199
*Phytocoris pabulinus*.......... 184
*Phytomyza affinis*.......... 51, 53, 164, 165, 215
*nigricornis* (see *P. affinis*).
*Phytonomus* (see *Hypera*).
*Phytophaga destructor*.......... 7, 124
*Phytoscaphus formosanus*.......... 207
*Piesarthrius marginellus*.......... 10
*Pieris monuste*.......... 49
Pigmy mangold beetle (see *Atomaria linearis*).
*Pileus hyalinatus*.......... 10
Pine bark beetle (see *Xylotrechus quadripes*).
bud and gall moths (see *Evetria* spp.).
moth (see *Gelechia dodecella*).
gall mite (see *Eriophyes pini*).
geometrid (see *Bupalus piniarius*).
needle midge (see *Thecodiplosis brachyntera*).
noctuid (see *Panolis griseovariegata*).
procession moths (see *Cnethocampa* spp.).
shoot moth (see *Evetria buoliana*).
spinner (see *Dendrolinus pini*).
*Pineus orientalis*.......... 67
*pini*.......... 67
*sibiricus*.......... 67
*strobi*.......... 67
Pink bollworm (see *Pectinophora gossypiella*).
*Pinnaspis bambusæ*.......... 32
*buxi*.......... 5, 44, 162
*longula*.......... 158
*rhombica*.......... 30
*Pionea ferrugalis*.......... 53, 93, 141, 164, 192
*forficalis*.......... 53, 138
*Pissodes harcyniæ*.......... 68
*notatus*.......... 68
*piceæ*.......... 68

Page.
*Pissodes pini* 68
    *piniphilus* 68
Pitchy-legged weevil (see *Brachyrhinus picipes*).
Pith moths (see *Blastodacna* spp.).
*Pityogenes bidentatus* 69
    *bistridentatus* 69
    *chalcographus* 69
    *coniferæ* 52, 69
    *lipperti* 74
    *pilidens* 69
    *quadridens* 69
    *trepanatus* 74
*Pityokteines curvidens* 69
    *spinidens* 79
    *vorontzowi* 79
*Pityophthorus exculptus* 81
    *glabratus* 75
    *lichtensteini* 75
    *micrographus* 69
    *sampsoni* 74
*Plantia affinis* 190
*Plateros dispallens* 212
*Platinglisia noacki* 35
*Platyparæa pœciloptera* 29
*Platypus biformis* 75
    *cupulatus* 218
    *curtus* 194
    *cylindrus* 154
    *taluræ* 194
*Plecoptera reflexa* 195
*Plemeliella abietina* 78
*Plocæderus obesus* 193
    *ruficornis* 143
*Plodia interpunctella* 6
Plum blister mites (see *Eriophyes* spp.).
    borer (see (*Rhynchites cupreus*).
    bud moth (see *Olethreutes pruniana*).
    fruit sawfly (see *Hoplocampa fulvicornis*).
    leaf sawfly (see *Priophorus padi*).
    stem piercer (see *Magdalis armigera*).
    psylla (see *Psylla pruni*).
    sawfly (see *Eriocampoides limacina*).
*Plusia argentifera* 216
    *chalcites* 210
    *gamma* 6, 44, 216
    *nigrisigna* 14
*Plutella maculipennis* 6, 49
*Podisma alpina* 11
*Podontia 14-punctata* 103
*Pœcilonota rutilans* (see *Lampra*).
    *variolosa* 181, 222
*Pogonochærus fasciculatus* 68
*Poliaspis cycadis* 162
    *pini* 73, 79
*Pollinia pollini* 156
*Polychrosis botrana* 130, 131
*Polydrusus cervinus* 39, 46
    *chærodrysius* 73
    *chrysomela* 39
    *griseomaculatus* 39
    *intermedius* 46, 73
    *lateralis* 39
    *micans* 39
    *mollis* 39
*Polydrusus picus* 39
    *planifrons* 46
    *sericeus* 6, 39
    *undatus* 46, 73
    *villosulus* 73
    *viridicollis* 6, 39
*Polygraphus aterrimus* 52
    *grandiclava* 75
    *himalayensis* 75
    *longifolia* 75
    *major* 52, 69
    *nigra* 75
    *pini* 69
    *polygraphus* 69
    *subopacus* 70
    *trenchi* 75
*Polyocha saccharella* 204
*Polyphylla fullo* 10, 39, 46, 73
*Pontania salicis* 223
*Pontia rapæ* 6
Poplar borers (see *Saperda* spp.).
    curculio (see *Cryptorhynchus lapathi*).
*Porricondyla cerealis* 124
    *gossypii* 89
Porter's white fly (see *Aleurothrixus porteri*).
*Porthesia similis* 40, 47, 108, 137, 141, 148, 149, 154, 181, 223
    *virguncula* 91
*Porthetria dispar* 6, 12, 40, 47, 107, 137, 141, 148, 154, 181, 223
Potato lady-bird beetle (see *Epilachna* spp.).
    root mite (see *Rhizoglyphus echinopus*).
*Praonetha melanura* 50, 63
*Prays citri* 57
    *curtisellus* 27
    *oleellus* 155
*Premnotrypes solani* 184
*Prionus corpulentus* 153
*Priophorus padi* 47, 133, 149, 170, 177, 179
*Prociphilus bumeliæ* 26, 78
*Procodeca adara* 208
*Prodenia litura* 14, 91, 191, 216, 217
*Promecotheca cumingii* 160
    *reichei* 160
*Prosternon holosericeus* 153
*Protodiaspis anomala* 9
*Psalis securis* 208
*Psallidium maxillosum* 44
*Psammœcus trimaculatus* 33
*Pseudaonidia* [see *Aspidiotus* (*Pseudaonidia*)].
*Pseudischnaspis* [see *Aspidiotus* (*Pseudischnaspis*)].
*Pseudoclavellaria amerinæ* 182, 223
*Pseudococcus acaciæ* 9
    *albizziæ* 10
    *ananassæ* 171
    *arecæ* 121
    *aurilanatus* 25
    *boninsus* 206
    *brevipes* 171
    *bromeliæ* 94, 171, 206
    *calceolariæ* 206
    *citri* 59
    *cocotis* 163
    *coffeæ* 63
    *dubia* 163

Page.

- *Pseudococcus farnesianæ* 10
  - *ficus* 102
  - *filamentosus* 10, 59, 130
  - *glaucus* 23, 158
  - *grandis* 131
  - *grassi* 34
  - *glaucus* 158
  - *indicus* 35
  - *laurinus* 35
  - *lobulatus* 99
  - *nitidus* 10
  - *pandani* 163
  - *pini* 73
  - *quæsitus* 10
  - *sacchari* 206
  - *saccharifolii* 206
  - *setosus* 102
  - *solitarius* 10
  - *subterraneus* 130
  - *swezeyi* 10
  - *texensis* 5, 206
  - *viburni* 219
  - *virgatus* 30, 63, 102, 131, 163
  - *vitis* 130
  - *vovæ* 139
- *Pseudocolaspis indica* 54
- *Pseudokermes nitens* 131
- *Pseudoparlatoria ostriata* 163
  - *parlatorioides* 30, 166
- *Pseudotargionia glandulosa* 9
- *Psiloptera fastuosa* 212
  - *viridans* 193, 218
- *Psyche* spp 211
  - *albipes* 211
  - *assamica* 211
  - *viciella* 197
- *Psylla alni* 11
  - *cistellata* 143
  - *mali* 16
  - *pruni* 172
  - *pyricola* 5
  - *pyrisuga* 167
- *Psylliodes attenuata* 44, 135
  - *chrysocephala* 44, 49, 188
  - *napi* 49, 188
- *Pteleobius kraatzi* 96
  - *vittatus* 96
- *Pterochlorus exsiccator* 39, 152
- *Pteronidea salicis* 223
  - *ribesii* 6
- *Pterostichus lepidus* 81
  - *vulgaris* 196
- *Ptilinus fuscus* 181, 222
  - *pectinicornis* 12, 39, 137, 148, 153, 222
- *Ptyelus costalis* 190, 206
- *Pulvinaria aurantii* 59
  - *betulæ* 39, 45, 132, 134, 137, 179, 181, 222
  - *alni* 11
  - *camelicola* 63
  - *cellulosa* 59
  - *cupaniæ* 131
  - *ficus* 63, 102, 131, 146
  - *floccifera* 158
  - *iceryi* 206
  - *jacksoni* 102
  - *mammeæ* 30, 63, 102, 146

Page.

- *Pulvinaria plana* 35
  - *sericea* 153
  - *simulans* 30
  - *theæ* 212
  - *vinifera* 130
- Purple scale of the orange (see *Lepidosaphes beckii*).
- *Purpuriscenus wachanrui* 181
- *Puto antennata* 73
- Pyralid of the vine (see *Polychrosis botrana*).
- *Pyrausta nubilalis* 85, 123, 135, 137
- *Pyrilla aberrans* 206
- *Pyroderces simplex* 88
- *Pyrrhidium sanguineum* 153
- *Pyrrhocoris apterus* 141
- Queensland fruit fly (see *Batrocera tryoni*).
- Quince borer (see *Cossus tristis*).
- *Racilia okinawensis* 190, 205
- Radish fly (see *Anthomyia radicum*).
- Rape flea-beetle (see *Psylliodes* spp).
  - seed worm (see *Evergestis extimalis*).
- Rarotonga fruit fly (see *Dacus rarotongæ*).
- Red-banded thrips (see *Heliothrips rubrocinctus*).
  - coffee borer (see *Zeuzera coffeæ*).
  - gooseberry mite (see *Bryobia ribis*).
  - gum-tree weevil (see *Strongylorhinus ochraceus*).
  - -headed fir worm (see *Enarmonia rufimitrana*).
  - -legged ham beetle (see *Necrobia rufipes*).
  - maggot of cotton (see *Porricondyla gossypii*).
  - palm weevil (see *Rhynchophorus ferrugineus*).
  - plum maggot (see *Laspeyresia funebrana*).
  - spider (see *Tetranychus* spp.).
  - tail moth (see *Dasychira pudibunda*).
- *Remigia frugalis* 208
- *Reseliella piceæ* 81
- *Rhabdocnemis obscurus* 34, 163, 201
- *Rhabdophaga* spp 222
  - *nielsonii* 222
  - *saliciperda* 182, 222
  - *salicis* 222
- *Rhadinoscopus nociturnus* 64
- *Rhagium mordax* 46
- *Rhagoletis pardalina* 93
- *Rhigopsidius tucumanus* 183
- *Rhinaria perdix* 47, 197
- Rhinoceros beetle (see *Oryctes rhinoceros*).
- *Rhinomacer attelaboides* 73
- *Rhinotia hæmoptera* 10
- *Rhizococcus intermedius* 39
  - *lobatulatus* 10
  - *pulchellus* 39
  - *totaræ* 39
- *Rhizœcus eloti* 63
  - *falcifer* 130, 163, 192
  - (?) *terrestris* 163
- *Rhizoglyphus* (*Coepophagus*) *echinopus* 5, 158, 164, 183
- *Rhizopertha collaris* 17
  - *dominica* 6
- *Rhizotrogus æquinoctialis* 43

Page.
*Rhopalopus insubricus* 148
*Rhynchites alni* 39
    *betulæ* 12,39,46
    *cæruleus* 173
    *cupreus* 173,174
*Rhyncolus ater* 68
*Rhyncolus cylindricus* 68
    *elongatus* 68
    *himalayensis* 52,68
    *lignyarius* 40,68
    *porcatus* 68
    *strangulatus* 68
    *truncorum* 40,68
*Rhynchophorus ferrugineus* 161
    *palmarum* 161,207
    *signaticollis* (see *Rhynchophorus ferrugineus*).
*Ricania tæniata* 206
Rice bug (see *Lepocorisa varicornis*).
    flea-beetle (see *Chætocnema basalis*).
    leaf-beetle (see *Hispa ænescens*).
    hopper (see *Tettigoniella spectra*).
    skipper (see *Parnara mathias*).
    stem borer (see *Chilo auricilia; Schoenobius bipunctifer*).
*Rioxa musæ* 34,118
*Ripersia fagi* 39
    *palmarum* 163
    *sacchari* 206
*Riptortus fuscus* 207
Rose sawfly (see *Caliroa aethiops; Cladius pectinicornis*).
    scale (see *Leucaspis japonica*).
*Rosenbergia megacephala* 103
Rosy rustic (see *Hydrœcia micæa*).
Rust-red flour beetle (see *Tribolium ferrugineum*).
Rutherglen bug (see *Nysius vinitor*).
Rye midge (see *Lasioptera cerealis*).
    stem borer (see *Ochsenheimeria taurella*).
*Sacadodes pyralis* 91
Sago palm scale (see *Diaspis zamiæ*).
*Sahlbergella singularis* 50
*Saissetia discoides* 131
    *mirifica* 10
    *nigra* 63,94,102
    *oleæ* 5
    *psidii* 131,146
    *punctilifera* 146
San José scale (see *Aspidiotes perniciosus*).
*Saperda* spp 180
    *carcharias* 6,180,181,222
    *populnea* 180,181,182,222
    *scalaris* 23,39,179,180,181,220
Sawfly (see *Macrophya punctum-album*).
Saw-toothed grain beetle (see *Silvanus surinamensis*).
Scale insects (see Coccidæ) 7
*Scapteriscus didactylus* 49
*Scelodnota strigicollis* 128
*Schistoceros anobioides* 193
*Schizaspis lobata* 102
*Schizodactylus monstrosus* 89,90,215
*Schœnobius bipunctifer* 189
*Sciopteron regale* 129
    *tabaniformis* 181
*Scirpophaga auriflua* 208
    *chysorrhœa* 208
*Scirpophaga intacta* 208
    *monostigma* 208
*Scolytochelus ensifer* 96
*Scolytochelus kirschi* 96
    *multistriatus* 27
*Scolytoplatypus darjeelingi* 154
    *himalayensis* 79
*Scolytus aceris* 148
    *amygdali* 25,167
    *assimilis* 174
    *carpini* 137
    *deodara* 52
    *intricatus* 40,154
    *lævis* 96
    *major* 52
    *mali* 24,54,96,149,179
    *minor* 52
    *multistriatus* 96
    *pruni* 24,170,174
    *pygmæus* 96
    *ratzeburgi* 46
    *rugulosus* 6,46,149
    *scolytus* 27,96
*Scopelosoma satellitia* 40
*Scotinophora tarsalis* 207
Seed-corn maggot [see *Chortophila* (*Pegomya*) *fusciceps*].
*Selatosomus æneus* 68,153
*Selidosema excursaria* 10
    *lyciaria* 10
*Semiothisa liturata* 75
*Serenthia formosana* 207
*Serica assamensis* 193
*Serropalpus barbatus* 67
*Sesamia cretica* 85,196,203
    *nonagrioides* 208
*Sesia conopiformis* 154
    *culiciformis* 12
    *formicæformis* 223
    *myopæformis* 21,25
    *scoliæformis* 47
    *spheciformis* 12,27,47
    *vespiformis* 154
*Setenis indosinica* 73
    *lævis* 193
    *semiopaca* 68
    *semivalga* 193
Shallot fly (see *Chortophila cilicrura*).
She-oak root-borer (see *Stigmodera heros*).
Shot-hole borer of tea (see *Xyleborus fornicatus*).
Siamese grain beetle [see *Lophocateres* (*Ostoma*) *pusillus*].
Silky oak weevil borer (see *Æsiotes notabilis*).
*Silpha obscura* 43
*Silvanus advena* 212
    *surinamensis* 5
*Sinoxylon anale* 33,148,193,218
    *crassum* 148,193,218
    *perforans* 96,127,138,153
    *sexdentatum* 127
    *sudanicum* 100
*Siphonella pumilionis* 85
*Sirex gigas* 70
    *imperialis* 82
    *juvencus* 70
    *spectrum* 70,82
*Sitodrepa panicea* 6

Page.

- *Sitona* spp, 60
  - *flavescens*, 6, 38, 60, 165
  - *hispidula*, 6, 60, 165
  - *lineata*, 38, 60, 165
  - *linneellus*, 60
  - *meliloti*, 61
  - *sulcifrons*, 61
- *Sitotroga cerealella*, 6
- Smaller bamboo shot-hole borer (see *Dinoderus minutus*).
- *Smynthurus* sp, 14
- Social pear sawfly (see *Pamphilius flaviventris*).
- *Solenococcus fagi*, 39
  - *muratæ*, 130, 219
- South Sea guava fruit fly (see *Dacus psidii*).
- Soy bean moth (see *Laspeyresia glycinivorella*).
- *Spermophagus pectoralis*, 36
- *Sphærococcus acaciæ*, 10
- *Sphærotrypes assamensis*, 193
  - *globulus*, 193
  - *siwalikensis*, 193
- *Sphenophorus sordidus* (see *Cosmopolites*).
- *Sphenoptera aterrima*, 52
  - *gossypii*, 90
  - *lafertei*, 52
  - *neglecta*, 90
- *Spilosoma fuscinula*, 99
- Spinach aphis (*Myzus persicæ*).
  - leaf miner (see *Pegomya hyoscyami*).
- Spined log beetle (see *Xenocnema spinipes australiæ*).
- Spiny citrus white fly (see *Aleurocanthus woglumi*).
- *Spodoptera mauritia*, 8, 191, 210, 216
  - *pecten*, 208
- Spruce bark tortricid (see *Laspeyresia pactolana*).
  - borer (see *Tetropinum castaneum*).
  - cone moth (see *Laspeyresia strobilella*).
  - gall midge (see *Dasyneura piceæ*).
  - nest worm (see *Laspeyresia tedella*).
  - wood wasp (see *Sirex spectrum*).
- *Stauropus alternus*, 51, 64, 146, 212
- *Steganoptycha* (see *Enarmonia rufimitrana*).
- *Steirastoma depressum*, 50
- *Stenobothurus formosanus*, 205
- *Stenocranus saccharivora*, 198
  - *sacchari*, 206
- *Stenothrips* (?) *zehntneri*, 207
- *Stephanitis pyri*, 167, 168
- *Sternochetus gravis*, 143, 144
  - *mangiferæ*, 144, 145
- *Sternotomis bohemani*, 10
  - *imperialis*, 63
  - *regalis*, 63
- *Stigmodera heros*, 97
- *Stilpnotia salicis*, 181, 223
- *Stomaphis longirostris*, 152
  - *quercus*, 152
- Straw fly (see *Chlorops tæniopus*).
- Strawberry root weevil (see *Brachyrhinus ovatus*).
- *Stromatium barbatum*, 33, 212
  - *longicorne*, 212

Page.

- *Strongylocephalus agrestis*, 206
- *Strongylorhinus ochraceus*, 98
- *Strongylurus thoracicus*, 52
- *Strophosoma capitata*, 39, 46
  - *melanogramma*, 39, 46
- *Suana concolor*, 30, 132, 194
- *Subcoccinella 24-punctata*, 14, 43
- Sucking bug (see *Ceratopachys variabilis*).
- Sugar-cane ambrosia beetle (*Xyleborus perforans*).
  - borer (see *Metamasius sericeus*).
  - moths (see *Diatræa* spp.).
  - bud moth (see *Ereunetis flavistriata*).
  - frog hopper (see *Tomaspis* spp.).
  - hispid miner (see *Hispid wakkeri*).
  - leafhopper (see *Perkinsiella saccharicida*).
  - mealy bug (see *Pseudococcus texensis*).
  - moth borer of India (see *Chilo simplex*).
  - red spider (see *Tetranychus exsiccator*).
- Swete-potato stem borer (see *Omphisa anastomosalis*).
  - weevil (see *Cylas formicarius*).
- Swan moth (see *Porthesia similis*).
- *Sylepta derogata*, 91, 155
- *Symphyletes neglectus*, 10
  - *nigrovirens*, 10
  - *vestigialis*, 10
- *Syngenaspis parlatoreæ*, 81
- *Tachardia acaciæ*, 10
  - *fici*, 103
  - *lacca*, 103
- *Tæniotes scalaris*, 101
- *Tæniothrips pyri*, 5
- *Takahashia citricola*, 59
  - *japonica*, 59
- *Tanymecus rusticus*, 207
- *Taphrorychus bicolor*, 40, 170
  - *villifrons*, 40
- *Tapinostola musculosa* (see *Oria*).
- *Tarache catena*, 91
- *Targionia* [see *Aspidiotus* (*Targionia*)].
- Tarnished plant bug (see *Lygus pratensis*).
- Tea bag worms (see *Psyche* spp.).
- *Teara contraria*, 10, 100
- *Teia anartoides*, 10, 24, 113, 1
- *Teledapus dorcadioides*, 52, 8
- *Telicota augias*, 20
- *Tenebrioides mauritanicus*
- *Tephrites* [see *Dacus* (*Tephrites*)].
- *Termes australis*, 15, 59, 99
- *Termissa nivosa*, 99
- Termites (see Termitidæ)
- Termitidæ, 7
- *Tetigonia albida*, 206
  - *ferruginea*, 206
  - *viridis*, 190, 206
- *Tetraneura pallida*, 95
  - *ulmi*, 95
- *Tetranychus bimaculatus*, 197
  - *bioculatus*, 62, 212
  - *exsiccator*, 197

Page.
*Tetranychus telarius*.......................... 43
*Tetropium castaneum*.......................... 65, 68
*fuscum*.......................... 79
*oreinum*.......................... 52
*Tettigoniella spectra*.......................... 190
*Tettix formosanus*.......................... 205
*Thalaina clara*.......................... 10
*Thamnonoma wauaria*.......................... 120
*Thecodiplosis brachyntera*.......................... 72
*Thliptoceras octoguttata*.......................... 64
Three-striped fruit fly (see *Dacus diversus*).
Thrips (see Thysanoptera.)
*Thrips minuta*.......................... 207
*sacchari*.......................... 207
*serrata*.......................... 207
*tabaci*.......................... 5
Thysanoptera.......................... 7
Timber beetle (see *Nacerdes melanura*).
*Tinea granella*.......................... 6, 123
*Tipula oleracea*.......................... 44
*paludosa*.......................... 44
*Tischeria complanella*.......................... 54, 154
*simploniella*.......................... 154
Tobacco stem borer (see *Gnorimoschema heliopa*).
white flies (see *Aleyrodes* spp.).
*Tomaspis lepidior*.......................... 85, 197, 198
*postica*.......................... 85, 197, 198
*varia*.......................... 85, 197, 198
Tomato weevil (see *Desiantha nociva*)
*Tomicus* (*Myelophilus*) *minor*.......................... 69
*piniperda*.......................... 66, 69
Tonga fruit fly (see *Dacus tongensis*).
*Tortrix ashworthana*.......................... 22
*divulsana*.......................... 14
*histrionana*.......................... 82
*murinana*.......................... 79
*piceana*.......................... 70
*podana*.......................... 27, 40
*viburniana*.......................... 70
*viridana*.......................... 54, 152
*Toxotrypana curvicauda*.......................... 163
*Trabala vishnu*.......................... 194
*Trachea brasilinea*.......................... 126
*Tragocephala senatoria*.......................... 50
*Trialeurodes vaporariorum*.......................... 213
*Tribolium castaneum*.......................... 33
*confusum*.......................... 5, 33
*ferrugineum*.......................... 6
*Trichetra marginalis*.......................... 100
*Trichiocampus viminalis*.......................... 182
*Trichiosoma lucorum*.......................... 13, 47, 223
*Trichocera hiemalis*.......................... 219
*Tridactylus flavomaculatus*.......................... 205
*Trigonidium haani*.......................... 205
*Trilophidia annulata*.......................... 205
*Trinophylum cribratum*.......................... 52
*Triphæna pronuba*.......................... 216, 218
*Trochilium* spp.......................... 180
*amnatiæforme*.......................... 180
*apiformis*.......................... 180
*Tropidocephala brunneipennis*.......................... 206
*formosana*.......................... 206
*saccharivorella*.......................... 206
*Tryphocharia mastersi*.......................... 98
Page.
*Trypophlœus alni*.......................... 12
*Trypopremnon latithorax*.......................... 184
*Tryxalis nasuta*.......................... 205
Turnip flower beetle (see *Meligethes æneus*).
sawfly (see *Athalia spinarum*).
Twig cutter (see *Rhynchites cœruleus*).
*Uracanthus acutus*.......................... 24, 166, 179
*bivittata*.......................... 10
*cryptophagus*.......................... 59
*simulans*.......................... 10
*strigosus*.......................... 10
*triangularis*.......................... 10
*Vesperus* spp.......................... 127
*luridis*.......................... 127
*mauretanicus*.......................... 127, 157
*strepens*.......................... 127, 192
*xatarti*.......................... 127
Viburnum scale (see *Chrysomphalus perseæ*).
Victoria bean beetle fly (see *Zizera labradus*).
white ant (see *Termes australis*).
Vine flea-beetle (see *Haltica ampelophaga*).
*Vinsonia stellifera*.......................... 103, 146
*Virachola insocrates*.......................... 112, 132, 142, 180
*livia*.......................... 163, 180
Watercress caddis worm (see *Limnophilus flavicornis*).
Weevils.......................... 8
West Indian cane fly (see *Stenocranus saccharivora*).
sugar-cane borer (see *Metamasius hemipterus*).
sugar-cane root borer (see *Diaprepes abbreviatus*).
sweet-potato weevil (see *Euscepes batatæ*).
Wheat bulb fly (see *Hylemyia coarctata*).
moth (see *Tinea granella*).
plant louse (see *Aphis avenæ*).
stem borer (see *Nonagria uniformis*).
White ant (see *Coptotermes gestroi*).
Willow curculio (see *Cryptorhynchus lapathi*).
gall midge (see *Rhabdophaga* spp.).
leaf beetles (see *Crepidodera aurata; Phyllodecta* spp.).
Winter moth (see *Cheimatobia brumata*).
turnip gnat (see *Trichocera hiemalis*).
*Xenocnema spinipes australiæ*.......................... 195
*Xeris spectrum*.......................... 70
*Xestobium plumbeum*.......................... 39, 73
*rufovillosum*.......................... 12, 39, 53, 137, 138, 148, 153, 171
*Xiphidium varipenne*.......................... 190
*Xiphydrya camelus*.......................... 13, 40
*prolongata*.......................... 47
*Xoanodera regularis*.......................... 103
*Xyleborus andrewesi*.......................... 193
*bengalensis*.......................... 193
*coffeæ*.......................... 62
*cryptophagus*.......................... 181
*dryographus*.......................... 40, 95, 154
*eurygraphus*.......................... 75
*fallax*.......................... 193
*fornicatus*.......................... 211
*improbus*.......................... 154
*major*.......................... 193

Page.
- *Xyleborus monographus* 40, 96, 154
  - *morstatti* 64
  - *perforans* 193, 202
  - *schlichii* 193
- *Xylechinus pilosus* 70
- *Xylina ornithopus* 176
  - *socia* 96, 141, 176
- *Xylococcus filifer* 141
- *Xylonites retusus* 96
- *Xyloterus domesticus* 12, 40, 46, 137, 141, 148, 149, 154
  - *intermedius* 79
  - *lineatus* 70
  - *signatus* 40, 46, 141, 148, 154
- *Xylotrechus gahani* 103
  - *javanicus* 63
  - *quadripes* 63, 64
  - *rusticus* 181
  - *smei* 193, 212

Page.
- *Xylotrechus stebbingi* 153
- *Xylotrupes dichotomus* 207
  - *gideon* 207
- Yellow box borers (see *Phoracantha* spp.).
- *Zabrus gibbus* 126
- *Zamacra albofasciaria* 150
- *Zaratha cramerella* 50
- *Zeuzera coffeæ* 30, 51, 55, 62, 91, 142, 212
  - *eucalypti* 10
  - *pyrina* 6, 12, 27, 40, 46, 48, 96, 138, 141, 148, 149, 154, 181, 223
- *Zizera labradus* 37, 165
- *Zonabris floralis* 184
  - *14-punctata* 184
- *Zophodia convolutella* 120, 121
- *Zygina circumscripta* 206
  - *maculifrons* 190, 206
  - *subrufa* 190, 206

# PLANT INDEX.

Page.
- *Aberia caffra* (Kei apple) 115, 140
- *Abies* spp. (fir). 26, 64, 65, 66, 67, 68, 69, 70, 77–79, 103, 196
  - *balsamea* (balsam fir) 69, 70, 78
  - *excelsa* (see *Picea excelsa*).
  - *firma* 79
  - *fraseri* (She balsam) 78
  - *mariesii* 79
  - *nordmanniana* 67
  - *pectinata* (silver fir) 67, 69, 70, 77, 78, 79
  - *webbiana* 68, 70, 79
- *Acacia* spp 9–11, 20, 22, 27, 113
  - *arabica* (gum arabic) 9, 10
  - *armata* (kangaroo thorn) 9
  - *asak* 9
  - *baileyana* 10
  - *caffra* 10
  - *calamifolia* (broom wattle) 9
  - *catechu* 10, 211
  - *cyanophylla* (blue-leaved wattle) 9
  - *dealbata* (silver wattle) 10
  - *decurrens* (green wattle) 10, 97
  - *discolor* 9, 10
  - *farnesiana* (huisache) 10, 11
  - *greggii* (Texas mimosa) 10
  - *horrida* 10
  - *juniperina* 10
  - *koa* (koa) 10
  - *linearis* 9
  - *linifolia* 9
  - *longifolia* (Sydney golden wattle) 9, 10
  - *lophanta* (see *Albizzia*).
  - *melanoxylon* (blackwood acacia) 9
  - *microbotrya* 9
  - *modesta* 10, 211
  - *mollissima* (black wattle) 10, 97
  - *pendula* (weeping myall) 9, 10
  - *pulchella* 9
  - *pycnantha* (golden wattle) 9
  - *robusta* 10
  - *suaveolens* 10

Page.
- *Acalypha marginata* 62
- *Acer* spp. (maple) 17, 65, 105, 107, 108, 138, 147, 148, 150, 221
  - *campestre* 147
  - *negundo* (box elder) 147
  - *platanoides* (Norway maple) 147
  - *pseudoplatanus* (sycamore maple) 147
- *Achras* [see *Sideroxylon* (*Achras*)].
- *Acronychia lævis* (cheesewood) 114
- *Æsculus* spp. (horse-chestnut) 6, 12, 126, 137, 138
  - *hippocastanum* (horse-chestnut) 138
  - *pavia* (red buckeye) 138
- *Agathis australis* (kauri) 195
- Ak (see *Calotropis* sp.).
- *Albizzia* sp 211
  - *lophanta* (*Acacia*) 9
- Alder (see *Alnus* spp.).
- Alfalfa (see *Medicago sativa*).
- Algaroba (see *Prosopis* spp.).
- Alligator pear (see *Persea gratissima*).
- *Allium ascalonicum* (shalot) 157, 158
  - *cepa* (onions) 5, 28, 157, 158
  - *porrum* (leek) 28, 157
  - *roseum* 158
  - *sativum* (garlic) 28, 157, 158
  - *sphærocephalum* 158
- Almond (see *Amygdalis communis*).
  - Mexican (see *Terminalia catappa*).
  - Tropical (see *Terminalia* spp.).
- *Alnus* spp. (alder) 11–13, 65, 107, 108, 138, 150, 151, 221
  - *glutinosa* (black alder) 11
  - *incana* 11, 12
  - *nepalensis* 12
  - *rubra* 11
  - *viridis* (European green alder) 11
- *Aloe* spp 160
- *Amarantus* sp 42
- *Amelanchier* spp. (service berry) 20, 65, 184
- *Amygdalus* spp. (peach) 166, 167

Page.

*Amygdalus communis* (almond)......... 56, 166, 167
  *persica* (peach).......... 85, 92, 109, 113, 114, 115, 117, 129, 166, 167, 177, 179, 214
  *persica nucipersica* (nectarine)... 92, 114
*Anacardium occidentale* (cashew, wild guava). 109
*Ananas sativus* (pineapple)............ 118, 171, 204
*Angelica* sp................................ 52
*Annona* spp. (custard apple)............. 85, 93, 94
  *cherimola* (*cherimoya*)........... 93, 94, 114
  *humboldtiana*...................... 94, 113
  *muricata* (soursop)........... 62, 93, 94, 115
  *reticulata* (custard apple)............ 93
  *squamosa* (sugar apple).............. 94
*Anthocephalus cadamba*...................... 62
*Apium graveolens* (celery)................ 52, 53, 215
Apple (see *Malus malus*).
  black (see *Sideroxylon* [*Achras*] *australe*).
  custard (see *Annona squamosa*).
  Kei (see *Aberia caffra*).
  Malay (see *Eugenia malaccensis*).
  mammee (see *Mammea americana*).
  mountain (see *Eugenia malaccensis*).
  rose (see *Eugenia jambos*).
  star (see *Chrysophyllum cainito*).
Apricot (see *Prunus armeniaca*).
*Araucaria* spp.............................. 25
  *bidwillii*.......................... 25
  *excelsa* (Norfolk Island pine)...... 25
Arborvitae (see *Thuya* spp.)
*Arctium* sp................................. 52
*Areca catechu* (betel nut).................. 44
*Areca lutescens*............................ 44, 153
*Artemisia* spp.............................. 52
  *vulgaris* (mugwort)................ 123
*Artocarpus integrifolia* (jack fruit)........... 117
*Arundinaria* spp. (bamboo).............. 31, 32, 33
  *hindsii graminæ*................ 33
  *japonica*...................... 33
*Arundo* sp. (reed).......................... 123
Ash (see *Fraxinus* spp.).
  mountain (see *Sorbus* spp.).
  white (*Schizomeria ovata*).
Asparagus (see *Asparagus officinalis*).
*Asparagus acutifolius*...................... 29
  *officinalis* (asparagus). 5, 6, 27–29, 129, 157
  *umbellatus*....................... 29
Aspen (see *Populus tremula*).
*Aster* spp.................................. 20
*Atriplex* spp................................ 41
  *hastata*.............................. 61
  *hortensis* (orache)............... 41, 42, 158
  *patula*............................... 184
*Atropa belladonna* (belladonna).............. 115
*Avena sativa* (oats)............ 122, 124, 125, 126, 155
*Averrhoa carambola* (carambola)............. 115
Avocado (see *Persea gratissima*).
Bahama grass (see *Cynodon dactylon*).
Balsam fir (see *Abies balsamea*).
Bamboo (see also *Arundinaria*, *Bambusa*, *Cephalostachyum*, *Dendrocalamus*, *Melocanna*, *Phyllostachys*)..................... 31–33, 143
*Bambusa* spp. (bamboo)................... 31, 32, 33
  *distorta*.............................. 33
  *fortunei*.............................. 32
  *oliveriana*............................ 33
  *tessellata*............................ 32

Page.

*Bambusa tulda*.............................. 33
  *viridis*.............................. 33
  *viridi-striata*........................ 33
  *vulgaris* (feathery bamboo)........ 33
Banana (see *Musa sapientium*).
Banyan (see *Ficus benghalensis*).
Barbary fig (see *Opuntia vulgaris*).
Barley (see *Hordeum sativum*).
Basswood (see *Tilia* spp.).
*Bauhinia racemosa* (mountain ebony)........ 149
  *variegata*.......................... 211
Bay (see *Laurus* spp.).
Beans (see also *Phaseolus*, *Vicia*, *Glycine*).... 5, 6, 35–38, 60, 61, 64, 93, 129, 165, 184
Bean, broad (see *Vicia faba*).
  castor (see *Ricinus* spp.).
  French.............................. 38
  haricot (see *Phaseolus vulgaris*).
  jack (see *Canavalia* spp.).
  kidney (see *Phaseolus vulgaris*).
  lima (see *Phaseolus lunatus*).
  Madagascar........................ 37
  senna (see *Cassia* spp.).
  soy (see *Glycine hispida*).
  string (see *Phaseolus vulgaris*).
  Tonga............................... 37
Beech (see *Fagus* spp.).
Beet (see *Beta vulgaris*).
  sugar (see *Beta vulgaris crassa*).
Berseem (see *Trifolium alexandrinum*).
*Beta vulgaris* (beet).. 5, 6, 41–44, 129, 187, 197, 214, 219
  (mangel-wurzel)............... 41, 42
  (mangolds)....................... 41, 42
  *crassa* (sugar beets)...... 41, 42, 43, 197
  *cicla* (Swiss chard)............ 42
Betel nut (see *Areca catechu*).
*Betula* spp. (birch)....................... 6, 45–47, 107, 108, 138, 150, 151, 152, 177, 221
  *alba*................................. 45, 46
  *odorata*.............................. 45, 46
  *papyrifera*........................... 45
  *pubescens*............................ 45
  *verrucosa*............................ 45
Birch (see *Betula* spp.).
Black apple (see *Sideroxylon* [*Achras*] *australe*).
  sorrel (see *Rubus* spp.).
Blackthorn.......................... 105, 107, 111
*Bombax malabaricum* (silk cotton)........... 194
Books........................................ 15
Box (see *Buxus* spp.).
Bramble...................................... 177
*Brassica* spp............................ 48–50, 187
  *arvensis* (charlock).................. 92
  *campestris* (rutabaga)............. 193, 218
  *napus* (rape)........ 49, 91, 135, 187, 188, 218
  *oleracea acephala* (collard)........... 48
    (kale)......... 48, 140, 197
    *botrytis* (cauliflower)...... 6, 48, 52
    *capitata* (cabbage).......... 5, 6, 48, 49, 50, 61, 64, 91, 184, 187, 188, 214, 218, 219
    *caulo-rapa* (kohl-rabi)....... 140
  *rapa* (turnip)............... 6, 197, 218, 219
Brazil cherry (see *Eugenia braziliensis*).
Bromeliaceæ.................................. 202
Broom corn (*Holcus sorghum*).
Brussels sprouts (see *Brassica oleracea*).

Page.

- *Bryobia dioica* (bryony) ..... 92
- Buckeye (see *Aesculus* spp.).
- Buckthorn (see *Rhamnus* spp.).
- Bull-oak (see *Casuarina* spp.).
- Bunch cherry ..... 108
- Bushes ..... 110
- Butternut (see *Juglans cinerea*).
- Buttonwood (see *Platanus* spp.).
- *Butyrospermum parkii* ..... 116
- *Buxus* spp. (box) ..... 5, 48
- Cabbage (see *Brassicae oleracea capitata*).
- Cabuyao (see *Eugenia malaccensis*).
- Cacao (see *Theobroma cacao*).
- *Cajanus indicus* (pigeon pea, tur) ..... 36, 37
- *Calamagrotis lanceolata* ..... 124
- *Calamus* spp. (rattan) ..... 188
- *Calophyllum inophyllum* (round kamani) ..... 115
- *Calotropis* sp ..... 117
- *Camellia thea* (see *Thea sinensis*).
- *Canavalia* spp. (Jack bean) ..... 37
  - *indica* ..... 85
- Cane ..... 131
  - sugar (see *Saccharum officinale*).
- *Cannabis sativa* (hemp) ..... 123, 135
- Canteloupe (see *Cucumis melo*).
- Caoutchouc (see also rubber) ..... 50
- Cape weed ..... 215
- *Capparis pedunculosus* ..... 56
  - *roxburghi* ..... 56
- *Capsicum* sp. (pepper) ..... 115
- *Carica papaya* (papaya, pawpaw) ... 85, 115, 163, 201
  - *quercifolia* ..... 115, 163
- *Carissa arduina* (Natal plum) ..... 115
  - *diffusa* ..... 211
- *Carpinus betulus* ..... 106, 107, 108, 137
- Carrots (see *Daucus carota*).
- *Carum petroselinum* (parsley) ..... 164
- *Caryota urens* (wine palm) ..... 201
- Cashew (see *Anacardium occidentale*).
- Cassava (see *Manihot utilissima*).
- *Cassia* spp. (senna bean) ..... 85
  - *auriculata* ..... 211
- *Castanea* spp. (chestnut) ..... 38, 53, 54, 105
  - *vesca* ..... 54
  - *vulgaris* ..... 54, 152
- *Castilloa elastica* (Panama rubber) ..... 163
- Castor bean (see *Ricinus* spp.).
- *Casuarina* spp. (She-oak) ..... 97
- Catalpa (see *Catalpa* spp.).
- *Catalpa* spp. (Catalpa) ..... 5, 51
- Cauliflower (see *Brassica oleracea botrytis*).
- Cayenne cherry (see *Eugenia uniflora*).
- Ceara rubber (see *Manihot glaziovii*).
- Cedar (see *Cedrus* spp., *Chamaecyparis* spp.).
  - red (see *Juniperus* spp.).
  - white (see *Cedrus* spp.).
- *Cedrela toona* ..... 218
- *Cedrus* spp ..... 52
  - sp. (white cedar) ..... 52
  - *deodara* ..... 52
- *Ceiba* spp. (silk cotton) ..... 50
  - *bombaxi* (kapok) ..... 194
- Celery (see *Apium graveolens*).
- *Cephalostachyum pergracile* (bamboo) ..... 31, 33

Page.

- *Cestrum* sp. (Chinese inkberry) ..... 115
  - *nocturnum* (night-blooming jessamine) ..... 56
- *Chamæcyparis* spp. (cedar) ..... 94
  - *nutkaensis* ..... 94
  - *obtusa* ..... 94
  - *pisifera* ..... 94
- Chard (see *Beta vulgaris cicla*).
  - Swiss (see *Beta vulgaris cicla*).
- Charlock (see *Brassica arvensis*).
- Cheesewood (see *Acronychia laevis*).
- Chenopodiaceæ ..... 42
- *Chenopodium* spp. (goosefoot) ..... 41, 42
- Cherimoya (see *Annona cherimola*).
- Cherry (see *Prunus* spp.)
  - Jerusalem (see *Solanum capsicastrum*).
  - sour (see *Prunus cerasus*).
  - Surinam (see *Eugenia uniflora*).
- Chestnut (see *Castanea* spp.)
- Chicory (see *Cichorium intybus*).
- China berry (see *Melia azedarach*).
- Chinese inkberry (see *Cestrum* sp.)
  - orange (see *Citrus japonica*).
  - plum (see *Noronhia emarginata*).
- Chocolate ((see *Theobroma* spp.).
- *Chrysanthemum* spp ..... 215
- *Chrysobalanus* spp ..... 116
  - *ellipticus* ..... 115, 116, 139
  - *icaco* (Cocoa plum, jicaco) ..... 109, 115, 139
- *Chrysophyllum cainito* (Star apple) ..... 115
- *Cichorium intybus* (chicory) ..... 54
- *Cinchona* spp. (quinine) ..... 55, 62, 211
- *Cinchona ledgeriana* ..... 55, 62
- *Cineraria* spp ..... 215
- *Citrullus citrullus* (watermelon) ..... 220
- *Citrus* spp ..... 5, 55–60, 97, 114, 117, 162, 191, 212
  - *aurantium* or *sinensis* (orange) ..... 5, 15, 55, 56, 57, 58, 59, 60, 85, 97, 113, 114, 115, 117, 200
  - *decumana* (see *Citrus grandis*).
  - *grandis* (grapefruit) ..... 55, 60, 115
    - (pomelo) ..... 57
    - (shaddock) ..... 117, 118
  - *japonica* (kumquat) ..... 55, 60, 115
  - *aurantifolia* (lime) ... 55, 57, 59, 60, 114, 117, 200
  - *limonia* (lemon) ..... 5, 55, 57, 59, 60, 115, 117
  - *medica acida* ..... 59
  - *nobilis deliciosa* (mandarin orange) ... 57, 58, 60, 115
    - (tangerine) ..... 58, 59
  - *trifoliata* (see *Poncirus*).
- Clover (see *Trifolium* spp.).
  - Egyptian (see *Trifolium alexandrinum*).
- Cobnut (see *Corylus* spp.).
- Cobs ..... 108
- *Coccoloba uvifera* (sea-grape) ..... 109
- Cocoa plum (see *Chrysobalanus icaco*).
- Coconut palm (see *Cocos nucifera*).
- *Cocos nucifera* (coconut palm) ..... 5, 61, 109, 159, 160, 161, 162, 163, 201, 202
- *Coffea* sp ..... 50, 56, 59, 61–64, 113, 116, 211
  - *arabica* (Arabian coffee) ..... 61, 62, 63, 64, 115
  - *liberica* (Liberian coffee) ..... 61, 62, 63, 109

Page.
*Coffea robusta* ... 62
  *stenophylla* ... 64
Coffee (see *Coffea* spp.).
Cola (see *Sterculia acuminata*).
Collard (see *Brassica oleracea acephala*).
Conifers ... 6, 64–84, 170, 210
*Convallaria majalis* (Lily-of-the-Valley) ... 28
*Conyza squarrosa* ... 123
Corn (see *Zea mays*).
  broom (see *Holcus sorghum*).
  Guinea (see *Holcus sorghum*).
  Indian (see *Zea mays*).
  Kafir (see *Holcus sorghum*).
*Cornus* spp. (dogwoods) ... 95
  *sanguinea* ... 95
  *sericea* ... 95
*Corylus* spp. (filberts) ... 108, 133
  (hazelnut). 38, 107, 108, 133–135, 151, 175
  *avellana* ... 45, 133, 134
  *colurna* ... 134
  *tubulosa* ... 133
*Cosmos* spp ... 215
Cowpea (see *Vigna unguiculata*).
Cotton (see *Gossypium* spp.).
  silk (see *Bombax malabaricum*).
    (see *Ceiba* spp.).
Cottonwood (see *Populus* spp.).
*Cratægus* spp. (see *Mespilus* spp.).
*Crotalaria* spp ... 37, 165
Crucifers ... 6, 91, 92, 188, 218, 219
Cucumber (see *Cucumis sativus*).
*Cucumis* spp. (melons) ... 5, 92, 93
  (sweet melons) ... 92
  *melo* (canteloupe, muskmelon) ... 51, 150
  *sativus* (cucumber) ... 42, 92, 114
    (gherkins) ... 93, 129
*Cucurbita* spp. (gourds) ... 92, 122
  *maxima* (squash) ... 93
  *pepo* (pumpkin) ... 92
    *ovifera* (marrow) ... 92
Cucurbitaceæ ... 92, 93, 117, 183, 220
*Cupressus* spp. (cypress) ... 94
  *funebris* ... 94
  *glauca* ... 94
  *lambertiana* ... 64, 94
  *macrocarpa* (Monterey cypress) ... 94
  *pyramidalis* ... 94
  *sempervirens* ... 94
Currant (see *Ribes* spp.).
Custard apple (see *Annona* spp.).
*Cycas revoluta* (sago palm) ... 5, 159, 162, 193, 201
*Cydonia japonica* ... 186
  *oblonga* (quince) ... 17, 19, 114, 115, 186, 187
*Cynodon dactylon* (Bermuda grass) ... 200
Cypress (see *Chamæcyparis* spp., *Cupressus* spp.).
  Lambert's (see *Cupressus lambertiana*).
*Cytisus laburnum* ... 36
Daffodil (see *Narcissus* spp.).
*Dahlia* spp ... 85, 215
*Dalbergia sissoo* (sissu) ... 195
*Dammara* spp. (see *Agathis australis*).
Dandelion (see *Taraxacum officinale*).
Date (see *Phœnix dactylifera*).
*Daucus carota* (carrot) ... 51, 214, 215

Page.
*Dendrocalamus giganteus* (bamboo) ... 33
  *hamiltoni* ... 33
  *strictus* ... 31, 33
Deodar (see *Cedrus deodara*).
*Diospyros* spp. (persimmon) ... 170
  *ebenum* ... 170
  *kaki* (Japanese persimmon) ... 113, 115, 170
*Dodonea viscosa* ... 211
Dogwood (see *Cornus* spp.).
*Dolichos* spp ... 36
Drugs ... 84
Dry food products ... 84
*Durantha* spp ... 62
Durra (see *Holcus sorghum*).
Ebony, mountain (see *Bauhinia racemosa*).
Eggplant (see *Solanum melongena*).
Elengi tree (see *Mimusops elengi*).
Elm (see *Ulmus* spp.).
  cork (see *Ulmus* sp.).
Emmer (see *Triticum* spp.).
*Epilobium* spp ... 127
*Eriobotrya japonica* (loquat) ... 85, 112, 114, 115, 142
*Erythrina lithosperma* (coral tree) ... 62
*Eucalyptus* spp ... 15, 20, 97–100
  *amygdalina* (peppermint gum) ... 98
  *capitellata* ... 99
  *corymbosa* (bloodwood) ... 99
  *diversicolor* (karri) ... 99
  *dumosa* ... 98
  *globulus* (blue gum) ... 98, 99
  *gracilis* ... 99
  *hæmastoma* ... 98, 99
  *incrassata* ... 99
  *leucoxylon* ... 99
  *melliodora* (honey-scented gum) ... 98, 99
  *miniata* ... 98
  *oleosa* ... 98
  *patens* ... 98
  *piperita* (peppermint stringy-bark) ... 99
  *polyanthemos* ... 99
  *resinifera* ... 99
  *robusta* (swamp mahogany) ... 99
  *rostrata* (red gum) ... 98, 99
  *siderophloia* (broad-leaved iron-bark) ... 99
  *sieberiana* ... 99
  *stuartiana* (apple-scented gum) ... 97, 98
  *tessellaris* ... 99
  *uncinata* ... 98, 99
  *viminalis* (manna gum) ... 97, 98, 99
*Eugenia* spp ... 100, 113
  *braziliensis* ... 100, 115
  *jambos* (rose-apple) ... 100, 115
  *malaccensis* (Cabuyao, Malay apple, mountain apple) ... 57, 100, 115, 117
  *uniflora* (Surinam cherry) ... 100, 115, 116
*Euxolus* sp ... 42
Evergreen trees (see also Conifers) ... 131
*Evonymus europaeus* (spindle tree) ... 108, 138
Excrement, human ... 157
*Fagus* spp. (beech) ... 6, 38–40, 46, 65, 107, 108, 138, 150, 151, 180, 221
  *cliffortioides* ... 39
  *fusca* ... 39

Page.
*Fagus menziesii* 39
  *sylvatica* (European beech) 39, 40
Ferns 197
*Ficus* spp. (fig, rubber) 100–103, 172, 192
  *altissima* 103
  *australis* 101
  *benghalensis* (banyan) 100, 102
  *bergmanniana* 103
  *carica* (fig.) 5, 100, 101, 102, 103, 115
  *caudatifolia* 102
  *comosa* 103
  *cordifolia* 103
  *cunia* 103
  *elastica* (Assam rubber) 29, 100, 102, 103
  *glomerata* (cluster fig) 102, 103
  *indica* 102, 103
  *infectoria* 102, 103
  *laccifera* 103
  *macrophylla* (Moreton Bay fig) 101, 102
  *nervosa* 103
  *nota* 102
  *obtusifolia* 103
  *orbicularis* 102
  *palmata* 103
  *religiosa* (peepul tree) 102, 103
  *retusa* 102
  *roxburghii* 103
  *rubiginosa* 103
  *rumphii* 103
  *scandens* 102
  *tjakela* 103
  *walkeriana* 102
Fig (see *Ficus carica*).
  Barbary (see *Opuntia vulgaris*) 185
Filbert (see *Corylus spp.*).
*Firmiana colorata* 62
Fir (see *Abies spp.*).
  balsam (see *Abies balsamea*).
  Douglas (see *Pseudotsuga taxifolia*).
  silver( see *Abies pectinata*).
  white (see *Abies pectinata*).
Flax (see *Linum usitatissimum*).
Flour 122
Forests 104–108, 127
*Fragaria* spp. (strawberry) 65, 129, 196, 197
*Fraxinus* spp. (ash) 25, 27, 65, 138, 151, 180, 221
  *excelsior* 26
  *ornus* 25
  *oxyphylla* 26
  *viridis* 26
French beans 37
Fruits 93, 105, 106, 108–118, 119, 129, 172, 174
  cultivated 116, 172
  deciduous 108, 114
  stone 110
*Funtumia* spp 50, 195
  *elastica* (silk rubber, ire) 195
Furniture 15
*Galega officinalis* (Goat's rue) 60
Garlic (see *Allium sativum*).
*Geranium* spp 15, 215
Gherkins (see *Cucumis sativus*).
*Glycine hispida* 196
Gooseberry (see *Ribes* spp.).
Goosefoot(see *Chenopodium* spp.).
*Gossypium* spp. (cotton) 59, 62, 84, 86–91, 191

Page.
Gourd (see *Cucurbita* spp.).
Grains 7, 122–126, 189, 190, 193, 213, 214
Granadilla (see *Passiflora quadrangularis*).
Graminaceæ (see "Grains" and "Grasses").
Grape (see *Vitis* spp.).
Grapefruit (see *Citrus grandis*).
Grass 61, 109, 122–126, 193, 197, 199, 203, 206, 213
  Bahama (see *Cynodon dactylon*).
Greenhouse plants 65
*Grevillea* sp 62
  *robusta* (silky oak) 194, 195
Guava (see *Psidium* spp.).
  strawberry (see *Psidium cattleianum*).
  wild (see *Anacardium occidentale*).
*Guaiacum officinale* 56
Guinea corn (see *Holcus sorghum*).
Gum (see *Eucalyptus* spp.).
Hard woods 66
Hawthorn (see *Mespilus* spp.).
Hazel (see *Corylus* spp.).
*Helianthus* spp. (sunflower) 85, 215
Hemp (see *Cannabis sativa*).
  sann (see *Crotalaria* sp.).
Hemlock spruce (see *Tsuga* spp.).
Henbane (see *Hyoscyamus niger*).
*Heracleum* spp 52
Herbs 66, 109
*Herpephyllum caffrum* (Kaffir plum) 115
*Hevea brasiliensis* (Para rubber) 62, 164, 192
*Hibiscus esculentus* (okra) 50, 86, 155
*Holcus sorghum* (durra) 95, 195, 196, 203
  (Guinea corn) 200
  (Kafir) 140, 195
  (sorghum, broom corn) 36, 48, 95, 189, 195, 196, 203, 208
Honeysuckle (see *Lonicera* spp.).
Hops (see *Humulus lupulus*).
*Hordeum vulgare* (barley) 35, 122, 123, 124, 125, 126, 187
Hornbeam (see *Carpinus betulus*).
Horse-chestnut (see *Æsculus* spp.).
Horse-radish (see *Radicula armoracia*).
*Humulus lupulus* (hops) 5, 91, 123, 129, 135–137, 214
*Hyoscyamus niger* (henbane) 42
*Ipomœa batatas* (sweet potato) 200, 209, 210
Ire (see *Funtumia elastica*).
*Iris* spp 139, 157
Jaboticaba (see *Myrciaria* spp.).
Japanese plum (see *Prunus salicina*).
Jerusalem cherry (see *Solanum capsicastrum*).
Jicaco (see *Chrysobalanus icaco*).
Jobo amarillo (*Spondias* sp.) 113
Jobo de la India (*Spondias mangifera?*) 113
*Juglans* spp. (walnuts) 38, 53, 105, 133, 134, 151, 180, 219, 220, 221
  *cinerea* (butternut) 219, 220
  *nigra* (black walnut) 220
  *regia* (English walnut) 45, 220
Juniper (see *Juniperus* spp.).
*Juniperus* spp 67, 139, 140
  *canadensis* 139
  *cedrus* 139
  *chinensis* 139
  *communis* 139, 140
  *drupacea* 139

Page.
*Juniperus excelsa* 139
  *fœtidissima* 139
  *macrocarpa* 139
  *oxycedrus* 139
  *phœnicea* 139
  *recurva* 139
  *sabina* 139
  *sphærica* 139
  *torulosa* 139
  *virginiana* 139
Kafir (see *Holcus sorghum*).
Kaffir plum (see *Herpephyllum caffrum*).
Kale (see *Brassica oleracea acephala*).
Kamani, round (see *Calophyllum inophyllum*).
  winged (see *Terminalia catappa*).
Kauri (see *Agathis australis*).
Kei, apple (see *Aberia caffra*).
*Kickxia* spp. (see *Funtumia* spp.).
Kohl-rabi (see *Brassica oleracea caulorapa*).
Kola (see *Sterculia acuminata*).
Kumquat (see *Citrus japonica*).
*Kurrimia zeylanica* 56
*Lactuca* spp. (lettuce) 140, 141, 214, 215
Lambsquarter (*Chenopodium* or *Atriplex*) 41
Larch (see *Larix* spp.).
*Larix* spp. (Larch) 64, 65, 66, 67, 68, 69, 70, 83, 84, 108, 140
  *decidua* (europaea) 70, 82, 83, 140
  *europæa* (see *Larix decidua*).
*Lathyrus* spp 36
*Laurus* spp. (bay) 35
  *camphora* (camphor) 35
  *canariensis* 35
  *drymifolia* (see *Persea persea*).
  *indicus* 35
  *nobilis* (sweet bay) 35
Leather 5
Leek (see *Allium porrum*).
Legumes 165
*Lemna* spp 220
Lemon (see *Citrus limonia*).
*Lens esculenta* (lentil) 36, 165
Lentil (see *Lens esculenta*).
*Leptospermum* spp 97
Lettuce (see *Lactuca* spp.).
*Ligusticum* spp 52
*Ligustrum vulgare* (privet) 89
Lilies 183
Lily of the Valley (see *Convallaria majalis*).
Lime (see *Citrus aurantifolia; Tilia* spp.).
  sweet (see *Citrus aurantifolia*).
Linden (see *Tilia* spp.).
*Linum* spp 104
  *usitatissimum* (flax) 103, 104
*Lippia citriodora* (lemon verbena) 56
*Livistona humulis* (palm) 162
Loganberry (see *Rubus* spp.).
*Lonicera* spp. (honeysuckle) 129, 177
Loquat (see *Eriobotrya japonica*).
*Lotus* spp 36
Lucerne (see *Medicago sativa*).
*Lycopersicum esculentum* (tomato) 62, 93, 95, 115, 216, 217
Madagascar beans 37
Mahogany (see *Swietenia mahogani*).

Page.
Maize (see *Zea mays*).
Malay apple (see *Eugenia malaccensis*).
*Malus malus* (apple) 6, 15–24, 85, 105, 106, 111, 113, 114, 115, 129, 167, 173, 174, 175, 180
*Mammea americana* (mammee apple) 115, 118, 142
Mammee apple (see *Mammea americana*).
Mandarin (see *Citrus nobilis*).
Mangel-wurzel (see *Beta vulgaris*).
Mango (see *Mangifera indica*).
*Mangifera indica* (mango) 5, 50, 109, 113, 114, 115, 117, 142–147, 158, 200
Mangold (see *Beta vulgaris*).
*Manihot glaziovii* (Ceara rubber) 51, 192
  *utilissima* (cassava, tapioca) 51
Maple (see *Acer* spp.).
Marigold 215
Marrow (see *Cucurbita pepo ovifera*).
*Medicago sativa* (alfalfa) 6, 13–15, 61
  (lucerne) 14, 60, 61, 129
  *falcata* 13
Medlar (see *Mespilus* spp.).
*Melaleuca* sp 97
*Melia azedarach* (Chinaberry) 54, 55, 62, 84
*Melilotus officinalis* (melilotus) 61
*Melocanna bambusioides* (bamboo) 31, 33
Melons (see *Cucumis* spp.).
*Mespilus* spp. (hawthorn) 5, 17, 106, 107, 111, 132, 133, 175, 177
  (white thorn) 105, 121, 169
  *coccinea* 132
  *germanica* (medlar) 17, 115, 132
  *heterophylla* 132
  *monogyna* 132
  *oxyacantha* 132
  *pyracantha* 132
Mesquite (see *Prosopis* spp.).
Mexican almond (see *Terminalia catappa*).
  umbrella tree (see *Terminalia catappa*).
Millet (see *Panicum miliaceum*).
*Mimusops elengi* (elengi) 115
Mock orange (see *Murraya exotica*).
*Morus* sp. (mulberry) 56, 150
  *indica* 150
Moth (see *Phaseolus aconitifolius*) 37
Mountain apple (see *Eugenia malaccensis*).
  ash (see *Sorbus* spp.).
  ebony (see *Bauhinia racemosa*).
Mulberry (see *Morus* spp.).
Mung (see *Phaseolus mung*).
*Murraya exotica* (mock orange) 115
*Musa* spp. (banana, plantain) 33, 115, 172
  *paradisiaca* 33
  *sapientium* (banana) 33, 34, 85, 109, 114, 118, 201, 202, 204
Muskmelon (see *Cucumis melo*).
Mustard (see *Sinapis* spp.).
*Myrciaria* spp. (jaboticaba) 56
*Myrtus* spp 56
*Narcissus* spp 150
Nasturtium (see *Tropæolum* spp.).
Natal plum (see *Carissa arduina*).
Nectarine (see *Amygdalis persica nusipersica*).
*Nephelium lappaceum* 50
*Nicotiana tabacum* (tobacco) 41, 59, 95, 198, 207, 213–216, 217

Page.
*Noronhia emarginata* (Chinese plum)......... 115
Nettle, stinging......... 135
Nursery stock......... 119
Nuts......... 17,108,219
Oak (see *Quercus* spp.)......... 5
  cork......... 151
  silky (see *Grevillea robusta*).
Oats (see *Avena sativa*).
Okra (*see Hibiscus esculentus*).
*Olea* spp......... 26,27,127,155-157,212
  *chrysophylla*......... 156
  *europæa* (olive)......... 155,156
  *fragrans* (see *Osmanthus*).
  *verrucosa*......... 156
Olive (see *Olea* spp.).
Onion (see *Allium cepa*).
*Onobrychis sativa* (sainfoin)......... 66
*Ononis* spp......... 61
  *viscosa*......... 61
*Opuntia* spp. (prickly pear)......... 185,186
  *tuna*......... 115,185,186
  *vulgaris* (Barbary fig)......... 115,185,186
Orache (see *Atriplex hortensis*).
Orange (see *Citrus aurantium*).
  mandarin (see *Citrus nobilis*).
  mock (see *Murraya exotica*).
Orchard trees (see also fruits)......... 110,112
Orchids......... 5,158,159,183,202
*Oreodoxa regia* (royal palm)......... 159,192,201
*Orobus tuberosus*......... 165
*Oryza sativa* (rice)......... 122,123,189-191,203,207
*Osmanthus fragans*......... 156
Palm......... 59,159-163,188,204,212,217
  coconut (see *Cocos nucifera*).
  date (see *Phœnix dactylifera*).
  royal (see *Oreodoxa regia*).
  sago (see *Cycas revoluta*).
  toddy (see *Phœnix sylvestris*).
  wine (see *Caryota urens*).
*Pandanus* sp......... 115,204
  *odoratissimus* (screw pine)......... 163
*Panicum* sp......... 122
  *miliaceum* (millet). 85,122,123.126,149,203
  *sanguinale*......... 123
Papaya (see *Carica papaya*).
Para plum (see *Spondias* spp.).
  rubber (see *Hevea brasiliensis*).
Parsley (see *Carum petroselinum*).
Parsnips (see *Pastinaca sativa*).
*Passiflora* sp. (passion fruit)......... 116
  *quadrangularis* (granadilla)......... 85, 115,117,118,126
Passion fruit (see *Passiflora* sp.).
*Pastinaca sativa* (parsnips)......... 52,164,183,215
Pawpaw (see *Carica papaya*).
Pea (see *Pisum sativum*).
  field......... 165
  pigeon (see *Cajanus indicus*).
Peach (see *Amygdalis persica*).
Pear (see *Pyrus communis*).
  alligator (see *Avocado* spp.).
  prickly (see *Opuntia tuna*).
*Pennisetum* spp......... 189
Peppers, Spanish......... 183
*Persea americana*......... 30
  *carolinensis* (red bay)......... 30
*Persea gratissima* (avocado)......... 6, 29,30,56,62,109,115,200
  *persea* (*Laurus drymifolia*)......... 30
  *pittieri*......... 30
Persimmon (see *Diospyros* spp.).
  Japanese (see *Diospyros kaki*).
*Phaseolus aconitifolius* (moth)......... 37
  *lunatus* (lima bean)......... 35,37
  *mungo* (mung)......... 37
  *radiatus*......... 36
  *vulgaris* (bean)......... 35-38,60,61,115
    (haricot)......... 38
    (kidney bean)......... 38
*Phleum pratense* (timothy)......... 122,126,213
*Phœnix dactylifera* (date palm).. 94,159,161,162,163
  *sylvestris* (toddy palm)......... 159,161,217
*Photinia* spp......... 62
*Phyllostachys* spp. (bamboo)......... 31,32
  *bambusoides*......... 32
*Phylocalyx* sp......... 113
*Picea* spp. (spruce)......... 64,65,66, 67,68,69,70,79-82,103,108,129,196
  (Siberian spruce)......... 69
  *alba*. (white spruce)......... 81,108
  *excelsa* (Norway spruce). 67,68,69,70,79,80,81
  *morinda*......... 68,69,70,81,82
  *omorica*......... 81
  *orientalis*......... 67
  *pungens* (Colorado spruce)......... 81
  *sitchensis* (Sitka spruce)......... 80,81
Pine (see *Pinus* spp.).
  Aleppo (see *Pinus halepensis*).
  Murray (see *Pinus frenela*).
  Siberian stone (see *Pinus cembra*).
  Scotch (see *Pinus silvestris*).
  Weymouth (see *Pinus strobus*).
Pineapple (see *Ananas sativus*).
*Pinus* spp. (pine)......... 45, 64,65,66,68,69,70-77,108,129,150,170
  *austriaca* (Austrian pine)......... 69,73,74
  *cembra* (Swiss stone pine)......... 67,69,73
  *densiflora* (Japanese red pine)......... 73
  *excelsa*......... 68,69,70,73,74,75
  *filifolia*......... 73
  *frenela* (Murray pine)......... 64
  *gerardiana*......... 69,73,74,75
  *halepensis* (Aleppo pine)......... 72,74
  *khasya*......... 74
  *laricio* (Austrian pine)......... 72,73,76
  *laricio nigricans*......... 72
  *longifolia*......... 69,73,74,75,76,211
  *maritima* (cluster pine)......... 69
  *montana* (Swiss mountain pine). 67,70,72,74
  *mughus*......... 70
  *pinea* (stone pine)......... 69,76
  *pinaster* (cluster pine)......... 69,73,75,76
  *pumilio*......... 73
  *resinosa* (red pine)......... 72
  *silvestris* (Scotch pine)......... 65, 66,67,69,70,72,73,74,75,221
  *strobus* (white pine, Weymouth pine). 65, 67,69,72,75
  *thunbergii* (Japanese black pine)......... 73
Pistachio (see *Pistacia* spp.).
*Pistacia* spp. (pistachio)......... 157,171
  *lentiscus*......... 171

Page.
*Pistacia terebinthus*.......... 171
    *vera* (pistachio).......... 171
*Pisum sativum* (pea).......... 5, 6, 36, 37, 60, 164, 165, 196, 197, 214, 215
Plane tree (see *Platanus* spp.).
*Plantago lanceolata*.......... 184
Plantain (see *Musa* spp.; *Plantago* spp.).
*Platanus* spp. (buttonwood, sycamore).......... 171
    *orientalis* (oriental plane).......... 171
Plum (see *Prunus* spp.).
    Japanese (see *Prunus salicina*).
    Kafir (see *Herpephyllum caffrum*).
    Natal (see *Carissa arduina*).
    Para (see *Spondias* spp.).
*Polygonum* spp.......... 41
Pomegranate (see *Punica granatum*).
Pomelo (see *Citrus grandis*).
*Poncirus trifoliata* (trifoliate orange).......... 59
Poplar (see *Populus* spp.).
*Populus* spp. (poplar).......... 12, 106, 107, 108, 138, 180–183, 221
    *alba* (white poplar).......... 181, 182, 221, 222
    *balsamifera* (balsam poplar).......... 181
    *canadensis*.......... 180
    *ciliata*.......... 181
    *dilatata*.......... 181
    *euphratica*.......... 180, 181
    *laurifolia*.......... 181, 221
    *monilifera*.......... 181
    *nigra* (black poplar).......... 180, 181
    *tremula* (aspen).......... 29, 150, 180, 181
    *virginiana*.......... 181
*Portulaca oleracea* (purslane).......... 42, 186
Potato (see *Solanum tuberosum*).
    sweet (see *Ipomœa batatas*).
Prickly pear (see *Opuntia* spp.).
Privet (see *Ligustrum vulgare*).
*Prosopis* spp. (mesquite, algaroba).......... 148
    *spicigera*.......... 148
Prune (see *Prunus* spp.).
*Prunus* spp.......... 172–180
    (cherry).......... 17, 20, 21, 53, 109, 113, 129, 169, 172, 173, 174, 175, 177, 179, 180
    (plum).......... 5, 17, 20, 21, 56, 105, 109, 111, 114, 166, 169, 172, 173, 174, 175, 176, 177, 178, 179, 190
    (prune).......... 172, 173
    (sloe).......... 17, 175
    *armeniaca* (apricot).......... 5, 21, 24, 25, 114, 115, 166, 167, 172, 178, 179
    *avium* (sweet cherry).......... 178
    *cerasus* (sour cherry).......... 115, 178, 179, 180
    *chamæcerasus* (ground cherry).......... 172
    *domestica* (plum).......... 45, 172, 178, 179
    *insititia* (damson plum).......... 172, 178
    *laurocerasus* (cherry laurel).......... 178
    *padus* (European bird cherry).......... 172, 178
    *pseudocerasus*.......... 178
    *salicina* (Japanese plum).......... 113, 180
    *spinosa* (blackthorn).......... 172, 178, 179
*Pseudotsuga* spp.......... 64
    *mucronata*.......... 69
    *taxifolia* (Douglas fir).......... 64, 65
*Psidium* spp. (guava).......... 85, 109, 112, 113, 114, 116, 117, 118, 131, 132, 200

Page.
*Psidium cattleianum* (strawberry guava)... 115, 132
    *guajava* (guava).......... 109, 113, 115, 131, 132
    *pomiferum*.......... 131
Pumpkin (see *Cucurbita pepo*).
*Punica granatum* (pomegranate).......... 112, 180
Purslane (see *Portulaca oleracea*).......... 186
*Pyrus communis* (pear).......... 5, 7, 17, 18, 19, 24, 105, 111, 113, 115, 129, 167–170, 174, 177
*Quercus* spp. (oak).......... 5, 12, 17, 27, 38, 53, 105, 106, 107, 108, 110, 121, 126, 127, 129, 133, 138, 150–155, 221
    (cork oak).......... 151
    *branti*.......... 153
    *castaneifolia*.......... 153
    *cerris*.......... 152, 153
    *coccifera*.......... 152, 153
    *dilatata*.......... 153, 154
    *griffithii*.......... 153
    *ilex* (holly oak).......... 152, 153
    *ilex ballota*.......... 153
    *incana*.......... 153, 154
    *lamellosa*.......... 154
    *lusitanica*.......... 152
    *macedonica*.......... 152, 153
    *montana* (chestnut oak).......... 152
    *nigra*.......... 152
    *palustris*.......... 152, 153
    *pedunculata*.......... 152, 153
    *prinus*.......... 153
    *pubescens*.......... 152, 153
    *robur* (English oak).......... 152, 153, 154
    *semicarpifolia*.......... 153
    *sessiliflora*.......... 127, 152, 153
    *suber* (cork oak).......... 152, 153
    *toza*.......... 153
Quince (see *Cydonia oblonga*).
Quinine (see *Cinchona* spp.).
*Radicula armoracia* (horseradish).......... 91, 138
Radish (see *Raphanus sativus*).
Rape (see *Brassica napus*).
*Raphanus raphanistrum* (white charlock).... 187
    *sativus* (radish).......... 19, 187, 188
Raspberry (see *Rubus* spp.).
Rattan (see *Calamus* spp.).
*Reseda* spp.......... 91
*Rhamnus* spp. (buckthorn).......... 48, 107, 108, 138
    *alaternus*.......... 48
    *frangula*.......... 48
*Rheum rhaponticum* (rhubarb).......... 91, 189
*Rhododendron* spp.......... 129
Rhubarb (see *Rheum rhaponticum*).
*Ribes* spp.......... 118–121
    (currant).......... 93, 118, 119, 120, 121
    (gooseberry).......... 93, 118, 119, 120
    (red currant).......... 121
    *alpinum* (Alpine currant).......... 118
    *nigrum* (black currant, var. Baldwin).. 118
        Black Dutch).. 118
        Black Naples).... 118
        Lee's Prolific)..... 118
    *rubrum* (red currant).......... 118
    *sanguineum*.......... 121

Page.
Rice (see *Oryza sativa*) .......... 189
*Ricinus* spp. (castor bean) .......... 85
*Roripa nasturtium* (watercress) .......... 220
*Rosa* spp. (rose) .......... 5, 106, 107, 109, 113, 121, 127, 129, 150, 169, 191, 192, 200
  (tea rose) .......... 151, 192
  *arvensis* .......... 191
  *canina* (dog rose) .......... 191
  *lævigata* (Cherokee rose) .......... 192
Rose (see *Rosa* spp.).
  apple (see *Eugenia jambos*).
*Rothra tinctoria* .......... 211
Rowan tree (see *Sorbus* spp.).
Rubber .......... 192
  Assam (see *Ficus elastica*).
  Ceara (see *Manihot glaziovii*).
  India (see *Ficus elastica*).
  Panama (see *Castilloa elastica*).
  Para rubber (see *Hevea brasiliensis*).
  silk (see *Funtumia elastica*).
*Rubus* spp .......... 47, 121
  (blackberry) .......... 47, 188
  (loganberry) .......... 47
  (raspberry) .......... 47, 61, 188, 197
*Rumex* spp. (sorrel) .......... 52, 135
Rutabaga (see *Brassica campestris*).
Rye (see *Secale cereale*).
*Saccharum officinarum* (sugar cane) .......... 5, 6, 34, 123, 160, 161, 189, 191, 197–208
Sago palm (see *Cycas revoluta*).
Sainfoin (see *Onobrychis sativa*) .......... 66
Sal (see *Shorea* spp.).
*Salacia reticulata* .......... 56
*Salix* spp. (sallow) .......... 111
  (willow) .......... 6, 12, 107, 108, 111, 128, 138, 151, 180, 221–223
  *alba* (white willow) .......... 222, 223
  *babylonica* .......... 222
  *caprea* (goat willow) .......... 222, 223
  *elegans* .......... 222
  *fragilis* (brittle willow) .......... 222, 223
  *purpurea* (purple osier) .......... 221, 222, 223
  *triandra* .......... 222, 223
  *viminalis* (osier willow) .......... 221, 222
  *viridis* .......... 222
Sallow (see *Salix* spp.).
*Salsola* spp .......... 41
Sann hemp (see *Crotalaria*).
Sapodilla [see *Sideroxylon* (*Achras*) *sapota*].
*Sarcocephalus esculentus* .......... 116
*Santalum album* (sandalwood) .......... 62
*Schinus dependens* .......... 56
  *molle* (California pepper tree) .......... 56
*Schizomeria ovata* (white ash) .......... 114
*Secale cereale* (rye) .......... 122, 123, 124, 125, 126, 187, 193
Sedges .......... 203
Senna bean .......... 85
Service berry (see *Amelanchier* sp.).
*Sesamia* spp .......... 92
*Setaria* spp .......... 187
Shaddock (see *Citrus grandis*).
Shallot (see *Allium* spp.).
She-oak (see *Casuarina* spp.).
*Shorea* spp .......... 193, 194
  *robusta* .......... 193, 194
*Shorea talura* .......... 193, 194
Shrubs .......... 105, 131, 172, 211
*Sideroxylon* (*Achras*) *australe* (black apple) . 114, 118
  *sapota* (sapodilla) . 114, 115, 194
Silk cotton (see *Bombax malabaricum; Ceiba* spp.).
  rubber (see *Funtumia elastica*).
Silky oak (see *Grevillea robusta*).
*Sinapis* spp. (mustard) .......... 92
Sissu (see *Dalbergia sissoo*).
Sloe (see *Prunus* spp.).
Solanaceæ .......... 56, 92, 183, 217
*Solanum* spp .......... 183
  *capsicastrum* (Jerusalem cherry) .... 115
  *melongena* (eggplant) ... 86, 95, 122, 216, 217
  *tuberosum* (potato) .......... 5, 61, 135, 183–185, 214, 217
*Solidago* spp. (goldenrod) .......... 104
*Sorbus* spp. (mountain ash) .... 20, 108, 138, 149, 177
Sorghum (see *Holcus sorghum*).
Sorrel (see *Rumex* spp.).
Sour cherry (see *Prunus cerasus*).
Sour sop (see *Annona* spp.).
Soy bean (see *Glycine hispida*).
Spelt (see *Triticum sativum*).
Spinach (see *Spinacia oleracea*).
*Spinacia oleracea* (spinach) .......... 5, 42, 196
Spindle tree (see *Evonymus europæus*).
*Spondias* spp. (Para plum) .......... 113, 164
  sp. (jobo amarillo) .......... 113
  *mangifera* (?) (jobo de la India) ..... 113
Spruce (see *Picea* spp.).
  Douglas (see *Pseudotsuga taxifolia*).
  hemlock (see *Tsuga* spp.).
  Siberian (see *Picea* spp.).
  white (see *Picea alba*).
Squash (see *Cucurbita maxima*).
Star apple (see *Chrysophyllum cainito*).
*Sterculia acuminata* (kola) .......... 109, 140
Straw .......... 126
Strawberry (see *Fragaria* spp.).
Succory (see *Cichorium intybus*).
Sugar beet (see *Beta vulgaris crassa*).
Sugar cane (see *Saccharum officinarum*).
Sunflower (see *Helianthus* spp.).
Surinam cherry (see *Eugenia uniflora*).
Sweet potato (see *Ipomœa batatas*).
*Swietenia mahagoni* (mahogany) .......... 62, 142
Sycamore (see *Platanus* spp.).
*Syringa* spp .......... 27
Tamarack (see Conifers).
Tamarind (see *Tamarindus indicus*).
*Tamarindus indicus* (tamarind) .......... 210
Tamarisk (see *Tamarix* spp.).
*Tamarix* spp. (tamarisk) .......... 211
  *gallica* .......... 211
  *mannifera* .......... 211
Tangerine (see *Citrus nobilis deliciosa*).
Tapioca (see *Manihot utilissima*).
*Taraxacum officinale* (dandelion) .......... 135, 215
*Taxus* spp. (yew) .......... 223
Tea (see *Thea sinensis*).
  rose (see *Rosa* sp.).
Teak (see *Tectona grandis*).
*Tectona grandis* (teak) .......... 212

Page.

- *Terminalia* spp ... 218
  - *bellerica* ... 218
  - *catappa* (winged kamani, tropical almond) ... 109, 115, 218
  - *chebula* ... 115, 218
  - *tomentosa* ... 218
- *Thea sinensis* (tea) ... 59, 62, 162, 211, 212
  - *viridis* ... 212
- *Theobroma* spp ... 50, 55
  - *cacao* (cacao) ... 50, 62, 85, 109, 115, 116, 195, 211
- *Thevetia neriifolia* ... 115
- Thistle ... 41
- Thorns ... 111
- Thorn, white ... 169
- *Thuya* spp. (arborvitæ) ... 25
  - *africana* ... 25
  - *occidentalis* ... 25
- *Tilia* spp. (linden, lime, basswood) ... 105, 107, 108, 138, 141, 142, 150, 176, 221
  - *cordata* (small-leaved linden) ... 141
  - *europæa* ... 141
  - *grandiflora* ... 141
  - *parvifolia* ... 14, 141
- Timbers ... 15, 193, 213
- Timothy (see *Phleum pratense*).
- Tobacco (see *Nicotiana tabacum*).
- Tomato (see *Lycopersicum esculentum*).
- Tonga beans ... 37
- Toon (see *Cedrela toona*).
- *Trifolium* spp. (clover) ... 6, 60, 61, 184, 214, 220
  - *alexandrinum* (Egyptian clover, berseem) ... 44
  - *pratense* ... 165
- *Triticum* spp. (emmer) ... 122, 220
  - *repens* ... 124
  - *sativum* (spelt) ... 122, 124, 220
  - *sativum* (wheat) ... 5, 122, 123, 124, 125, 126, 187, 220
- *Tropæolum* spp. (nasturtium) ... 215
- Tropical almond (see *Terminalia catappa*).
- *Tsuga* spp. (hemlock) ... 64, 135

Page.

- *Tulipa* spp. (tulip) ... 183
- Tuna (see *Opuntia* spp.) ... 185
- Tur (see *Cajanus indicus*) ... 37
- Turnip (see *Brassica rapa*).
- *Ulmus* spp. (elm) ... 55, 95, 96, 105, 106, 107, 108, 127, 138, 176, 221
  - sp. (cork elm) ... 96
  - *campestris* (English elm) ... 95, 96
  - *montana* ... 96
- Umbrella tree (see *Melia azedarach*).
  - Mexican (see *Terminalia catappa*).
- *Vaccinium* spp. (whortleberry) ... 20
- *Vachellia farnesiana* (see *Acacia farnesiana*).
- *Viburnum* spp ... 5, 219
- *Viburnum tinus* ... 219
- *Vicia* spp ... 36
  - *faba* (broad bean) ... 35, 36
  - *sepum* ... 36
- *Vigna unguiculata* (cowpeas) ... 36, 37, 38, 91
- Vines (see *Vitis* spp.).
- *Vitis* spp. (grape, vine) ... 5, 6, 15, 24, 109, 127–131, 150, 191
  - *æstivalis* (bunch grape) ... 127
  - *arizonica* (cañon grape) ... 127
  - *carinthiaca* ... 127
  - *vesuviana* ... 127
  - *vinifera* (grape) ... 115, 127, 130, 131
- Walnut (see *Juglans* spp.).
- Watercress (see *Roripa nasturtium*).
- Watermelon (see *Citrullus citrullus*).
- Wattle, black (see *Acacia mollissima*).
- Wheat (see *Triticum sativum*).
- White ash (see *Schizomeria ovata*).
- Whitethorn (see *Mespilus* spp.).
- Whortleberry ( *Vaccinium* spp.) ... 20
- Wild fruits ... 112, 116
- Willow (see *Salix* spp.).
- Yams ... 122
- Yew (see *Taxus* spp.).
- *Zea mays* (corn, maize) ... 6, 84, 85, 122, 123, 135, 142, 189, 197, 200, 203, 208, 214